

# 3161e 01



**GUIDELINE FOR USE  
AT CONTAMINATED  
SITES IN ONTARIO**

**JUNE 1996**



**Ministry of  
Environment  
and Energy**

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## Executive summary

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The Ministry of Environment and Energy (ministry) has prepared a revised guideline for use when property owners are cleaning up and/or redeveloping contaminated property in Ontario. The ministry has also prepared three accompanying documents which provide property owners and consultants with additional detailed information on parts of the revised guideline.

The Guideline for Use at Contaminated Sites, May 1996, (guideline) replaces the Guidelines for the Decommissioning and Clean-up of Sites in Ontario, February 1989 and the Interim Guidelines for the Assessment and Management of Petroleum Contaminated Sites in Ontario, August 1993 issued by the Ministry of the Environment.

The guideline does not change the legislative powers or the regulatory mandate of the ministry. The ministry has a mandate to deal with situations where there is an adverse effect, or the likelihood of an adverse effect, associated with the presence or discharge of a contaminant. This responsibility stems primarily from administering the Environmental Protection Act (R.S.O. 1990) and the Ontario Water Resources Act (R.S.O. 1990).

This guideline provides advice and information to property owners and consultants to use when assessing the environmental condition of a property, when determining whether or not restoration is required, and in determining the kind of restoration needed to allow continued use or reuse of the site. The ministry has provided the guideline, along with the supporting documentation, to assist landowners in making decisions on soil and/or groundwater quality for proposed or existing property uses.

Public communication is often an element in the site restoration process, particularly when a change in land use is involved. Public communication allows the proponent to receive public input and to address public concerns. The method(s) of public communication will depend on the complexity of the situation and the range of issues involved. Communication initiatives should be co-ordinated and integrated where possible to avoid duplication. The guideline suggests different levels of communication for the range of site restoration approaches.

### Approaches to site restoration

Three approaches for responding to site contamination are described. These approaches may be used when a decision has been made to remediate or restore a contaminated property. The approaches are: background, generic and site specific risk assessment.

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### Background approach

The background approach involves use of soil quality criteria to restore the site to ambient or naturally occurring "background" conditions. These background criteria were developed from an Ontario-wide sampling program at rural and urban parks unaffected by local point sources of pollution. If necessary, a proponent may develop background criteria to reflect local conditions by completing a sampling program as outlined in the guideline.

### Generic approach

The generic approach involves use of soil and groundwater quality criteria which have been developed to provide protection against the potential for adverse effects to human health, ecological health and the natural environment. The criteria may be applied to agricultural, residential/parkland and industrial/commercial land uses. Criteria are also provided for potable and nonpotable groundwater use. The potable criteria ensure that groundwater may be used as a source of drinking water. The nonpotable criteria offers protection against vapours from groundwater and to aquatic life in receiving surface water.

Generic soil criteria are provided for two depths of soil restoration and for two soil textures. Full depth restoration involves use of the same generic criteria to the full extent of contamination. When contamination extends deeper than 1.5 m from the surface a stratified restoration using different generic criteria below 1.5 m is an option. The texture of the subsurface material can influence the numerical value of the criteria and criteria values are provided for coarse and fine textured materials for many of the parameters.

Soil and groundwater criteria are provided for an extensive list of parameters. Analysis for all the criteria may not be necessary in all instances. Likewise, soil and groundwater analysis may sometimes be required for parameters not listed in the guideline. The decisions involved in site investigation and parameters for sample analysis are always based on consideration of the specific factors at each property.

The generic soil and groundwater criteria may be modified to reflect particular site conditions. This is done through modification of relevant variables in the models and process used to develop the generic criteria. If appropriate, criteria from another jurisdiction may be proposed for use, or new generic criteria may be developed if criteria are not provided for a particular contaminant.

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### Potentially sensitive sites

There may be sites where the physical site characteristics, or the ecological characteristics (plants and animals) are very different from those considered in the development of the generic criteria. For example, a potentially sensitive site is one where there may be a rare or endangered species which was not considered in the development of the generic criteria, but which may be affected by site contamination. In such a case, the generic criteria are inappropriate for use and more protective criteria will be needed.

There is a range of conditions/situations for which a site may be considered potentially sensitive and an ecological risk assessment may be used to establish protective criteria. In some cases consultation with other agencies such as the Ministry of Natural Resources or local conservation authority will be required in determining whether the site is a sensitive site.

### Site specific risk assessment approach

Site specific risk assessment (SSRA) and risk management are approaches which may be used instead of the background or generic approaches. The SSRA approach does not involve use of existing soil or groundwater quality criteria; rather this approach may be used to establish criteria for a site or a risk-based level of exposure protection.

Risk assessment is a scientific technique which estimates the health risk posed to humans, plants, wildlife and the natural environment from exposure to a contaminant. The principles of risk assessment were used in developing the generic soil and groundwater criteria. Because site specific characteristics are incorporated in a risk assessment, there will be numerical differences between the generic criteria which may apply at a site and those developed through SSRA. The level of health protection provided, however, remains the same as that provided by the generic criteria.

Risk management decisions may be made using the results of an SSRA. These decisions may lead to use of equipment or construction techniques to manage, control the movement of, or reduce the concentrations of contaminants over time, independent of or in conjunction with site reuse.

When risk management decisions involve use of engineered measures to reduce the levels of risk at a site, the type of monitoring and maintenance required for the technique(s) used and the responsibility for ensuring that it/they continue(s) to operate

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as designed must be outlined in a risk management plan.

### The investigation and restoration process

A four-step process is outlined in the guideline. The activities undertaken at each step will depend on site specifics and may vary from one site to another.

1. Site assessment – involves the systematic gathering of information to identify actual or potential contamination at the property.
2. Sampling and analysis – is intended to confirm and delineate the presence or absence of contamination at the site.
3. Remedial work plan – involves the development and implementation of a plan to restore the site to the appropriate condition and verify that restoration has taken place as planned.
4. Completion – involves summarizing the information gathered in the three previous steps, and may involve providing a record of site condition to the ministry when remedial work has been undertaken.

The responsibility for ensuring that the site restoration work is completed in a manner consistent with the information provided in the guideline, and that the site is suitable for the intended use or reuse, remains with the property owner and those undertaking the work. The guideline does not eliminate the need for decision-making or the use of professional skills and judgment when site restoration is being undertaken.

### Administration and record keeping

A form called the Record of Site Condition (RSC) provides a mechanism for the property owner and the consultant(s) who performed or supervised the site assessment or restoration work to indicate that work has been completed in keeping with guideline information. Receipt of the RSC will be acknowledged by the ministry. The ministry will review the RSC and, on an audit basis, conduct further reviews to ascertain whether the statements provided are reliable. The audit will provide the ministry with a mechanism to monitor use of the guideline and to identify modifications and improvements for future implementation.

The RSC should be provided to ministry when the stratified approach or certain forms of risk management, as specified in the guideline, are used. Use of these approaches

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creates a need for notification to be provided to those who may have a future interest in the restored property. A public notification mechanism which uses an order issued under Section 18 of the EPA is provided in the guideline.

The order directs the property owner to register a certificate of prohibition (issued under Section 197 of the EPA) on the title of the property. The certificate of prohibition requires that information about the restored site be provided to persons who wish to acquire an interest in the site prior to having any dealings with the site. This allows persons who wish to acquire an interest in the property to become familiar with any possible conditions or restrictions on property use which they may face, before acquiring the restored property.

### Land use planning

A planning application which proposes the reuse or redevelopment of a contaminated or potentially contaminated site may require approval through a number of different planning mechanisms as required by the Planning Act (R.S.O. 1990). The site assessment process and the application review process may be integrated so that concerns are identified and addressed at the appropriate time. Municipalities may use a number of planning mechanisms to provide direction to applicants. The opportunities and considerations for use of some of these mechanisms are outlined in the guideline.

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## Glossary of terms

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<i>absorption</i>	means the process by which a chemical enters the circulatory system following ingestion, inhalation or dermal exposure.
<i>ACM</i>	asbestos containing material
<i>adverse effect</i>	means one or more of, <ul style="list-style-type: none"><li>(a) impairment of the quality of the natural environment for any use that can be made of it,</li><li>(b) injury or damage to property or to plant or animal life,</li><li>(c) harm or material discomfort to any person,</li><li>(d) an adverse effect on the health of any person,</li><li>(e) impairment of the safety of any person,</li><li>(f) rendering any property or plant or animal life unfit for human use,</li><li>(g) loss of enjoyment of normal use of property, and</li><li>(h) interference with the normal conduct of business.</li></ul>
<i>approval</i>	means a Certificate of Approval issued under the EPA or an approval issued under the OWRA.
<i>background concentration</i>	means the ambient concentration of a chemical in the soil, groundwater, air or sediment in the local environment which is representative or typical of the conditions in urban or rural setting.
<i>coefficient of variation</i>	means a statistical measure which permits a comparison of the amount of variation within sets of sample results which have different means. It is calculated by expressing the sample standard deviation as a percent of the sample mean.
<i>contaminant</i>	means any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination of any of them resulting directly or indirectly from human activities that may cause an adverse effect.

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<i>contamination</i>	refers to a chemical which is present in soil or other material to which this guideline applies, at a concentration greater than background, or which is not naturally occurring in the soil or other material to which this guideline applies.
<i>criteria</i>	are numerical values for the concentrations of chemical substances in soil, groundwater and sediments that relate to the suitability of a site, for specific uses and land-use categories.
<i>dermal absorption</i>	means the process by which a chemical enters the circulatory system following exposure to or contact with the skin.
<i>end point</i>	refers to an effect on a human or ecological receptor that can be measured and described in some quantitative fashion.
<i>ecological receptor</i>	means a nonhuman organism identified as potentially experiencing adverse impacts from exposure to a contaminant, either directly through contact or indirectly through food chain transfer.
<i>EPA</i>	Environmental Protection Act (R.S.O. 1990)
<i>ERA</i>	Ecological risk assessment
<i>ESA</i>	Environmental site assessment
<i>exposure</i>	means the contact between a contaminant and an individual or population. The exposure may occur through pathways such as ingestion, dermal absorption or inhalation.
<i>exposure pathway</i>	means the route by which a receptor comes into contact with a contaminant.
<i>full depth site condition</i>	means that neither the surface and subsurface soil quality exceeds the soil quality criteria specified in Tables A or B.
<i>generic criteria</i>	are the criteria for soil, groundwater and sediment quality, which are listed in Tables A to D.

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<i>hazard</i>	means the adverse impact on health or property which results from the presence of or exposure to a substance. In some instances the substance itself is also referred to as the hazard, rather than the adverse impact which the substance causes.
<i>land use approval authority</i>	means the government representative or body empowered by federal, provincial or municipal legislation to grant approval for the use of land, including activities, buildings, structures and associated infrastructure, within their respective jurisdictions.
<i>leaching</i>	means the process by which contaminants in soil are dissolved and removed by water percolating through the soil.
<i>macronutrient</i>	means a chemical element necessary for the growth of plants, usually at concentrations greater than 1 ppm in the plant.
<i>MCCR</i>	Ministry of Consumer and Commercial Relations
<i>MOEE</i>	Ministry of Environment and Energy
<i>municipality</i>	means the corporation of a county, metropolitan area, regional area, district area, city, town, village, township improvement district, or the County of Oxford, and includes a local board thereof and a board, commission or other local authority exercising any power with respect to municipal affairs or purposes, including school purposes, in an unorganized township or unsurveyed territory.
<i>natural environment</i>	means the air, land and water, or any combination or part thereof, of the Province of Ontario.
<i>90<sup>th</sup> percentile</i>	refers to the point in a population of analysis results which is greater in value than 90 percent of the population and is smaller in value than 10 percent of the population.
<i>nonpotable criteria</i>	are the soil and groundwater criteria listed in Tables B and D.
<i>overburden</i>	means unconsolidated material that nearly everywhere forms the surface of the land in the absence of true soil and rests on bedrock.

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<i>OWRA</i>	Ontario Water Resources Act (R.S.O. 1990).
<i>person responsible</i>	means the owner, or the person in occupation or having the charge, management or control of a source of contaminant.
<i>pollutant</i>	means a contaminant other than heat, sound, vibration or radiation, and includes any substance from which a pollutant is derived.
<i>potable criteria</i>	are the soil and groundwater criteria listed in Tables A and C which establish when groundwater quality is suitable for human consumption.
<i>proponent</i>	means any person or corporation that conducts or plans to conduct any site assessment or site restoration activity as outlined in this guideline.
<i>public consultation</i>	is the process of communication that promotes discussion between the proponent and the consulted party, and provides the consulted party with the opportunity to influence the decisions of the proponent.
<i>public notification</i>	is the process of communication that provides information to the notified group, but does not necessarily provide an opportunity for the notified group to influence a decision.
<i>receptor</i>	means the person or organism, including plants, subjected to chemical exposure.
<i>reference dose</i>	an estimate of a daily exposure (mg/kg/day) to the general human population, including sensitive sub-groups, that is likely to be without an appreciable risk of deleterious effects during a lifetime of exposure.
<i>remedial work plan</i>	means a plan to bring about the restoration of the site.
<i>restoration</i>	includes improving in the quality of, remediation, cleanup or other management of soil, groundwater or sediment so that the site will be suitable for the intended use.

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<i>risk assessment</i>	is the scientific examination of the nature and magnitude of risk to define the effects on both human and other receptors of the exposure to contaminant(s).
<i>risk management</i>	is the implementation of a strategy or measures to control or reduce the level of risk estimated by the risk assessment.
<i>soil</i>	means the unconsolidated material on the immediate surface of the earth that serves as a natural medium for the growth plants.
<i>spill</i>	<p>when used with reference to a pollutant, means a discharge,</p> <ul style="list-style-type: none"><li>(a) into the natural environment,</li><li>(b) from or out of a structure, vehicle, or other container, and</li><li>(c) that is abnormal in quality or quantity in light of all the circumstances of the discharge,</li></ul> <p>and when used as a verb has a corresponding meaning.</p>
<i>SSRA</i>	Site specific risk assessment
<i>stratified site condition</i>	means the surface soil quality at a site is not worse than the soil quality criteria specified in Tables A or B and the subsurface soil quality does not exceed the soil quality criteria specified in Tables C or D.
<i>subsurface soil</i>	means overburden which is more than 1.5 metres from the soil surface, excluding the thickness of any non-soil surface treatment such as asphalt, concrete or aggregate.
<i>surface soil</i>	means soil or overburden which is 1.5 m or less from the soil surface, excluding the thickness of any non-soil surface treatment such as asphalt, concrete or aggregate.
<i>teratogenicity</i>	means the ability of a chemical to cause a change in the normal development process of an unborn organism, resulting in permanent alterations in the biochemical, physiological or

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anatomical functions of the organism.

*threshold*

means the concentration or dose of a chemical below which an adverse impact is not expected to occur.

*volatilization*

means the process by which a chemical converts from a liquid or solid phase into a gaseous phase and disperses into the air.



## Answers to frequent questions

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The following section is a list of questions that will be frequently asked by users of this guideline. The information contained in the questions and answers listed below forms part of MOEE's policy interpretation of this guideline.

**I. I have already started remedial work at my site and have been using the 1989 guideline and the Interim Position (1994). What are my options now that the 1996 guideline has been released?**

The site assessment and investigation process in both guidelines is similar and either may be adapted for your site. The Guideline for Use at Contaminated Sites (1996 guideline) provides more soil and groundwater criteria and more options for site restoration than the 1989 guideline did. If you want the MOEE to acknowledge receipt of your record of site condition, outlined in the 1996 guideline, you should follow the process outlined in the 1996 guideline.

If you received written MOEE concurrence with the remedial work plan for your site prior to the release of this guideline, you have the option of continuing to restore your site using the guidance provided in the 1989 guideline and Interim Position (1994) and receiving a sign-off letter on completion. This means using the soil criteria provided in the 1989 guideline and those available through the Interim Position (1994). Please note, a sign-off letter will only be provided if MOEE has concurred in writing with the remedial work plan prior to the date on this guideline.

This guideline takes effect on July 1, 1996.

**II. Last year I cleaned up my site in full accordance with the Guidelines for the Decommissioning and Clean-up of Sites in Ontario (1989 guideline) and the Interim Guideline for the Assessment and Management of Petroleum Contaminated Sites in Ontario (1993 guideline). Should I investigate and clean up my site again?**

The revised guideline (1996 guideline) does not require property owners to investigate and clean up sites to the new criteria.

### **III. What is the Ministry's position if changes to criteria concentration limits are developed in the future?**

The contaminant concentrations listed in the guideline are protective of human health and the environment and as a result, we do not expect any changes to these values. In the event that changes or revisions are required in the future, they will be posted on the Environmental Registry and/or undergo independent consultation with stakeholders prior to being implemented. MOEE would take no action against individual property owners who have followed earlier versions of the guideline. If significant health or environmental problems were identified during the development of the amended criteria with sites that had already been cleaned up, longer term approaches would be developed in full consultation with property owners to ensure that they were environmentally protective and economically feasible.

### **IV. How can I tell if conditions at my site are likely to cause an adverse effect?**

Adverse effect is a term defined in the EPA and it forms the basis for how MOEE can legally get involved with site remediation. This guideline does not change the definition of adverse effect; however, it does provide information which may be used to assist in determining whether site conditions are causing, or are likely to cause, an adverse effect. From a practical perspective, MOEE has not used the powers granted by this term frivolously.

A site will have no environmental adverse effect when the generic criteria levels in Tables A to D or levels developed as part of a full site specific risk assessment (SSRA) clean up have been met. Physical hazards such as the potential for explosion may also have to be considered. There may be circumstances where concentration limits at a site may exceed the guideline values and still not create an "adverse effect"; this can only be determined on a case-by-case basis.

## Answers to frequent questions

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**V. I own an operating gas station. Does this guideline change who I notify if there is petroleum-related contamination on my site?**

The installation and operation of product storage and dispensing equipment at a private or retail gasoline facility, or associated product outlet, is regulated by the Gasoline Handling Act administered by MCCR. This guideline does not change your obligation to provide notification to MCCR if there is a spill or leak at your site, as required by the Gasoline Handling Code (section 12.1). Notification of a spill must also be provided to the MOEE, as required by the EPA (section 92), and the need to provide notification to MOEE and MCCR is unchanged by this guideline.

If the contaminant at your site is not from a spill, and is causing or likely to cause an adverse effect as defined in the EPA (section 1), then you must provide notification to the ministry as required by the EPA (section 15).

The options for corrective action, which may be required at your operating site, are outlined in GH-13 of the Gasoline Handling Code. Information on collecting and analyzing soil and groundwater samples is provided in Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario (MOEE, 1996a)

**VI. I have permanently closed my gas station. Who do I notify if petroleum-related contamination is found during site closure and may I still use the 1993 guideline?**

The requirements for equipment removal, site remediation and notification at a closed station are outlined in the Gasoline Handling Code (section 12.3). The code specifies that the MCCR, MOEE and municipality must be notified 30 days prior to the discontinuance of use of the facility.

Notification must be provided to the MOEE if the contamination at your site is causing, or is likely to cause, an adverse effect, or may impair the quality of groundwater or surface water.

If site restoration is needed, the criteria provided in the 1996 guideline may be used to establish appropriate restoration levels. The 1996 guideline provides more options for site restoration, and more criteria for soil and groundwater quality than the 1989 guideline or 1993 guideline. The soil criteria provided for use with the decision tree in the 1993 guideline cannot be replaced with soil

## Answers to frequent questions

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criteria from the 1996 guideline. The 1993 guideline may only be used if the circumstances outlined in the answer to question I apply.

**VII. I am going to have an environmental site assessment done at my property. Does this guideline require that soil and groundwater samples be analyzed for all 117 chemical parameters listed in Appendix 2?**

No. The information provided in the 1996 guideline and companion documents allows you to assess sources of contamination at a site, and determine what kind of sample analysis will be required to evaluate the likely presence of contamination. Conversely, analysis might be required for compounds suspected or known to be present at a site, but which are not listed in the tables of criteria provided in Appendix 2. Guidance on developing or adopting criteria is provided in section 6 of the 1996 guideline.

**VIII. I am planning to use the site specific risk assessment approach (SSRA) at my site. Will this require more work than using the generic or background approach?**

Using the SSRA approach will require more site characterization information, more technical and scientific effort, and more administrative steps than using the background or generic approaches.

When using the SSRA approach, you must: have a peer review of the risk assessment documentation completed; submit reports to the ministry for review; complete the registration on title process if Level 2 risk management measures are used; monitor and maintain any Level 2 risk management measures as required and consult with the appropriate municipality regarding the use of SSRA and agreements on maintenance of Level 2 measures. The administrative requirements are described in section 7.2, while roles and responsibilities for an SSRA are summarized in Table 8d.

**IX. May I still use generic criteria from other jurisdictions and under what circumstances?**

When criteria are not provided by this guideline, criteria from another jurisdiction may be proposed for use. The proposed criteria may be appropriate for use if the same human health and ecological protection components were considered in the development of that criteria, as were considered in the development of the generic criteria provided in this guideline. You will have to

## Answers to frequent questions

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provide background information for MOEE review and determination of whether or not the proposed criteria are appropriate for adoption.

**X. I am planning to do a site assessment and clean up my site. When should I contact the MOEE?**

You do not need to communicate your intention to do a site assessment to the MOEE prior to doing the site assessment. If, from the assessment, a site condition is found to be causing, or is likely to cause, an adverse effect, you must then notify the MOEE of the condition (section 15, EPA). During the remedial stage, the need to communicate with the MOEE will depend on the restoration approach you select. The background approach and generic approach may be carried to completion, and communication with the MOEE may be required only at the end of the process. The SSRA approach requires that you provide documentation to the MOEE for review as part of the process.

**XI. Will the MOEE still issue sign-off letters when a proponent completes the site restoration process?**

No. The MOEE will acknowledge receipt of the Record of Site Condition when it is provided by the proponent.

**XII. What is the purpose of the three accompanying documents to the guideline? Do I have to read them all?**

These documents provide:

- guidance on completing a site assessment including sampling, handling and analytical methods for soil, sediment, water and air;
- guidance on completing a site specific risk assessment;
- a detailed explanation on how the generic criteria were developed.

These reference documents are made available to provide more detailed information than this guideline provides on a variety of topics. Users of the guideline should be familiar with the additional guidance provided in these documents to better understand things such as the process of developing the generic criteria, issues to be considered when planning to use risk assessment at a site, and to understand the benefits and limitations of different sampling

## Answers to frequent questions

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methods for various media.

# Introduction

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## 1.0 Guideline purpose

This document provides guidance on the following:

- ▶ a process which may be used in the assessment of contaminated or potentially contaminated sites;
- ▶ three approaches which may be used for site restoration;
- ▶ soil, groundwater and sediment criteria which may be used when restoring contaminated sites;
- ▶ use of risk assessment and risk management strategies at contaminated sites.

This guidance is provided to assist proponents when making decisions and responding to conditions encountered at contaminated sites, and to allow proponents to independently complete the site restoration process. Knowledge of the specific environmental conditions at a site must always be considered when making decisions about using the different approaches to site restoration described in this guideline.

This guideline, with the companion documents, provides a consistent framework to proponents involved with activities at contaminated sites. These documents contain practices, procedures and approaches for dealing with contaminated sites which are recommended by the Ministry of Environment and Energy (ministry) for use in the assessment and restoration of contaminated sites.

## 1.1 Use of the guideline

This guideline is not a regulation and does not change the legislative powers or the regulatory role of the ministry. The role and powers of the ministry, when dealing with contaminated sites, are outlined primarily in the Environmental Protection Act (R.S.O. 1990), Ontario Water Resources Act (R.S.O. 1990) and the Pesticides Act (R.S.O. 1990). The Environmental Protection Act places an obligation on persons who cause or permit the discharge of a

# Introduction

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contaminant into the natural environment to notify the ministry, when the contaminant is causing an adverse effect, or is likely to cause an adverse effect.

This guideline, and the companion documents noted at the end of section 1.4, update, and replace the guidance and criteria provided in both the Guidelines for the Decommissioning and Cleanup of Sites in Ontario published by the Ministry of the Environment in 1989, and the Interim Guideline for the Assessment and Management of Petroleum Contaminated Sites in Ontario released by the ministry in August 1993.

This guideline, and the companion documents, also replace the Proposed Guidelines for the Cleanup Of Contaminated Sites in Ontario (July 1994a) and the Interim Position on the Cleanup of Contaminated Sites in Ontario (July 1994b).

The ministry will use the information in this guideline when asked to provide comments or advice to proponents and other ministries or agencies on matters related to assessment and restoration of the environment. Agencies or individuals who are making use of this guideline may consult with the ministry when interpretation of the information provided in the guideline is required.

Where this guideline uses mandatory language such as "must" or "shall" in relation to situations where a person who has authority to make decisions under statute, such as a ministry director, must exercise discretion, that language only indicates the usual course of events and is not intended to limit or fetter the decision maker's discretion.

## Directed by proponent

A proponent may use this guideline to assess, or restore a site for a variety of self-directed or self-initiated purposes. The information provided in this guideline allows proponents to make decisions about the site assessment and restoration process which may be required at a site. Except where otherwise noted in this guideline, proponents may complete the restoration process independently. A proponent who is making use of this guideline may consult



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with the ministry when interpretation of the information provided in the guideline is required.

## Other agencies

Provincial or municipal agencies may decide to make use of this guideline, or may direct a proponent to use this guideline. For example, use of the guideline criteria may be a condition of the granting of a municipal permit, a condition of the granting of an approval for a plan of subdivision, or as a condition of granting a rezoning or site-plan approval.

The remediation of leaks and spills at operating petroleum hydrocarbon storage and distribution facilities is regulated by the Fuels Safety Program, Ministry of Consumer and Commercial Relations (MCCR) under the Gasoline Handling Act (R.S.O. 1990) and the Energy Act (R.S.O. 1990). As such, any matters pertaining to spills and environmental remediation at such operating facilities (e.g. gasoline service stations, bulk plants, fuel storage tanks) will be guided by appropriate MCCR legislation and referenced guidelines. When a spill occurs, the Ministry of Environment and Energy must be notified and the relevant provisions of ministry legislation including Part X – Spills of the Environmental Protection Act must also be complied with.

## 1.2 When is site restoration necessary?

Restoration is necessary if the contamination at a site is causing, or is likely to cause, an adverse effect. An adverse effect, or the likelihood of an adverse effect, associated with the presence of contamination in soil, groundwater or sediments may warrant use of the site assessment process and criteria provided in this guideline. The specific environmental conditions at a site must always be considered when evaluating whether site contamination will, or is likely to, cause an adverse effect.

Restoration of a site is often necessary when recent or historic site activities have resulted in the presence of a contaminant, and a change in the current land use is being considered. Restoration is usually undertaken when the level of contamination is greater than the generic soil and groundwater criteria for the new land use.

There may be situations where the ministry will require the restoration of a contaminated site. This may be done through legislative authority under the Environmental Protection Act (R.S.O. 1990), the Ontario Water Resources Act (R.S.O. 1990) or the Pesticides Act (R.S.O. 1990).

### 1.3 Limitations on the use of this guideline

This guideline is not intended to relieve a proponent from meeting requirements of ministry legislation, orders, approvals or other legislation. Except to the extent this guideline is made applicable by ministry order or approval, this guideline is not intended to apply to:

- ▶ closure of approved waste disposal sites and facilities;
- ▶ facilities or sites with closure conditions specified in fulfilment of the requirements of the Mining Act (R.S.O. 1990);
- ▶ facilities or sites required to meet terms and conditions of an Environmental Assessment Act (R.S.O. 1990) exemption order or approval.

The generic criteria provided in Appendix 2 (Tables A – D) have been developed to protect against adverse effects to human health, ecological health and the natural environment. These generic criteria do not address other concerns, such as the potential for explosive conditions, the potential for corrosive conditions, or the potential for creating an unstable condition for foundations. Use of the generic criteria may eliminate such conditions; however additional work may be required to ensure that corrosive, explosive or unstable conditions will be eliminated, or will not exist at a site in future.

### 1.4 Accompanying documentation

The three companion documents to this guideline provide:

- ▶ a detailed explanation of all the factors considered in the development of the generic soil, groundwater and sediment criteria provided with this guideline;

# Introduction

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- ▶ a description of a range of sampling techniques for soil, groundwater, sediment and air samples, and a listing of analytical detection limits and methodologies for use when samples are analyzed;
- ▶ guidance on the use of human and ecological health risk assessment, when risk assessment is being used at a contaminated site.

Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario (May 1996a)

Guidance on Site Specific Risk Assessment for Use at Contaminated Sites in Ontario (May 1996b)

Rationale for the Development and Application of Generic Soil, Groundwater, and Sediment Criteria for Use at Contaminated Sites (May 1996c)

## 2.0 Guideline principles

Five principles have been used in the development of this guideline to ensure that a consistent and equitable process is available to those involved with, and affected by, site restoration and site management activities. These principles are listed below.

- ▶ This guideline is consistent with and should not conflict with any of the requirements of the Environmental Protection Act (R.S.O. 1990), Ontario Water Resources Act (R.S.O. 1990), Pesticides Act (R.S.O. 1990), Environmental Assessment Act (R.S.O. 1990) or any other Ontario statute.
- ▶ This guideline was developed to provide protection of human health, ecological health and the natural environment from potential adverse effects associated with existing or future exposure to contaminated soil, sediment, and groundwater.
- ▶ The public should be kept informed of the site restoration process.
- ▶ Action by the ministry related to this guideline and/or the issuance of written statements acknowledging receipt of a record of site condition is not intended to release other persons or groups from liability under statutory or common law.
- ▶ It is the responsibility of the owner, occupant of a property, or other person responsible to ensure all activities related to the site restoration comply with all relevant federal, provincial, and municipal legislation/policies.

# Communication

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## 3.0 Public communication

The ministry recommends that proponents consider the goals listed below when designing a public communication plan. These goals are provided as general guidance. The specific conditions and situation at each site must always be considered in determining the methods and the extent of communication required to meet these goals.

- ▶ Providing a forum for receiving public input and information on potential sources of contamination at the site (neighbours and employees should be specifically consulted when gathering site history information).
- ▶ Providing initial and ongoing information to the public as needed, on the nature and extent of site contamination and the activities proposed for site restoration.
- ▶ Allowing public input to the parts of the remedial work plan, such as soil excavation, treatment and/or transportation, which may generate noise, dust or other effects on air quality which may affect local residents.
- ▶ Addressing public concerns before major site activity begins and maintaining a record of the communications program.

Development of a public communications plan is best done with knowledge of specific site details, such as site size, adjacent land uses/designations, proximity of neighbours, nature of the planned corrective action and the nature of the contamination at the site.

Lines of communication with the interested and affected persons or groups may be established early in the site investigation process and should be maintained throughout the period of site activity. Public communication should be organized and timed to allow mutually satisfactory resolution of the concerns likely to be raised. The ministry recommends that at least 30 days notice of site activity be provided to the people or groups who will be affected by the activity.

Proponents may consider use of one or more of the following methods of public communication when developing a communication plan:

- ▶ posting a notice on the property as is done for some rezoning;
- ▶ advertising in the local newspapers or community bulletins;
- ▶ delivering flyers or newsletters door to door;
- ▶ using dedicated telephone lines to provide or receive information;
- ▶ placing material in local libraries, community centres or establishing a temporary local office;
- ▶ holding public meetings, information sessions or an open house;
- ▶ establishing a public advisory or liaison committee.

A summary of the different approaches to site restoration and the relationship of the approach to a suggested form of public communication is outlined in Table 3a. The suggested form of public communication for each approach is meant to serve as a guide to proponents. The restoration approaches are explained in sections 5, 6, and 7 of this guideline. Even when not required by statute, a good communication plan may help to avoid problems which might arise later in the process.

It is not necessary for ministry staff to be involved in the planning and implementation of the public communication process. The recommendations provided in Table 3a may be considered the minimum public communication recommendations of the ministry for the respective restoration approach.

### 3.1 Communication and land use planning

The process of restoring contaminated sites is often one step in the larger process of land-use designation change, site alteration, or rezoning as governed by the Planning Act (R.S.O. 1990). In some instances, there may be more than one process involved, such as when an approval is also required under the Environmental Assessment Act (R.S.O. 1990).

Changes in land use are regulated by the provincial or municipal governments. There are usually specified requirements for public consultation or notification when changes in land use are being proposed. These public communication requirements are based on the principle that the public should be notified,

# Communication

consulted or participate in land-use planning matters. This guideline uses the term public communication to include both consultation and notification.

Whenever possible, communication with the public on issues related to the restoration of contaminated sites should be included as part of the broader public communication program, as required by the land-use planning or approval process to provide effective and efficient communication. Proponents are advised to consult with the local land-use planning approval authority to determine the requirements for public communication. Where there is a legal requirement for communication under more than one statute, proponents should ensure that their notices reflect the rules of each legal requirement, to avoid having to provide notice separately for each requirement.

Table 3a: Forms of public communication <sup>1</sup>

Approach	Suggested form of communication
<ul style="list-style-type: none"> <li>• full depth restoration</li> <li>• potable groundwater restoration</li> </ul>	<ul style="list-style-type: none"> <li>• notification to adjacent landowners</li> </ul>
<ul style="list-style-type: none"> <li>• stratified site condition</li> <li>• nonpotable groundwater restoration</li> </ul>	<ul style="list-style-type: none"> <li>• notification to adjacent landowners and municipality</li> </ul>
<ul style="list-style-type: none"> <li>• site specific risk assessment with Level 1 risk management</li> </ul>	<ul style="list-style-type: none"> <li>• consultation with adjacent landowners, extended neighbourhood and municipality</li> </ul>
<ul style="list-style-type: none"> <li>• site specific risk assessment with Level 2 risk management</li> </ul>	<ul style="list-style-type: none"> <li>• consultation with adjacent landowners and extended neighbourhood</li> <li>• consultation with municipality, for use of risk assessment and/or risk management (see section 7)</li> </ul>

<sup>1</sup> best undertaken in conjunction with prescribed land-use planning consultation process

## Restoration approaches

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### 4.0 Approaches to site restoration

This chapter outlines three approaches to site restoration which may be used by a proponent when dealing with a contaminated site. The selection of an approach, or combination of approaches, is a decision made by the proponent and may be based on a number of factors including the present and desired physical site conditions, the intended reuse, and the administrative processes which accompany each approach. Sections 5, 6 and 7 provide detailed descriptions of each approach and an explanation of how they may be used in the site restoration process. The three approaches are:

- ▶ Background
- ▶ Generic
- ▶ Site specific risk assessment (SSRA)

### 4.1 Background approach

The background approach involves the restoration of a site to naturally occurring background conditions, or ambient soil concentrations. Use of this approach will lead to restoration of the site to pre-contamination levels. Natural background concentrations or ambient levels of a chemical do not usually cause adverse effects. Restoration to background levels may proceed by making use of the background soil criteria included with this guideline (Appendix 2, Table F). If desired, a proponent may also develop background criteria for use in the restoration of a contaminated site. Section 5 provides additional information on the background approach.

### 4.2 Generic approach

The generic approach involves the use of generic soil and groundwater criteria which are based on the effect of a contaminant on human health and/or the environment. These criteria have been developed using environmental exposure models which rely on conservative or protective assumptions about exposure to contaminants. This is to ensure that the generic criteria are applicable for the restoration of most contaminated sites in Ontario.



# Restoration approaches

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The generic criteria may not always be appropriate for use at all sites. Potentially sensitive sites, because of unique physical site conditions, or because of the presence of unique site receptors, may require a higher level of protection than that provided through the modelling of contaminant movement and model assumptions used in the development of the generic criteria. Guidance on potentially sensitive sites is provided in section 6.1. Factors other than those listed in section 6.1 may apply in determining whether a site is potentially sensitive under the Planning Act and policies under that act.

The generic approach offers options for site restoration which are designed to allow proponents to match certain site attributes to the appropriate generic criteria. These attributes are based on the following:

- i. land use (agricultural, residential/parkland, industrial/commercial);
- ii. restoration of groundwater quality (potable/nonpotable);
- iii. depth of soil restoration;
- iv. soil texture.

There are options within each of these site attributes which are used to guide a proponent in selecting the generic criteria appropriate for use. The options associated with the generic approach are described in section 6.

## 4.3 Site specific risk assessment approach

The site specific risk assessment approach (SSRA) provides a process and administrative mechanism to develop and use criteria based on environmental and human health at a specific site. Site specific criteria must be protective of human and ecological health and of the natural environment at the site in question. The risk assessment process incorporates the environmental and ecological characteristics of the site and the characteristics of its use. The risk assessment may involve modification of one or more of the components used in the development process for generic criteria to reflect site specific characteristics, or may involve a more comprehensive risk assessment and risk management process.

The risk assessment process involves hazard assessment (hazard identification and toxicity assessment), exposure assessment and subsequent characterization of the identified risk. The risk assessment may incorporate risk management

## Restoration approaches

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decisions, or the results of risk assessment may be applied through risk management techniques. In this guideline the term Level 1 risk management refers to situations when the risk assessment incorporates risk management decisions which do not change the level of risk in the assessment. When the risk assessment involves changing the level of risk, or the results of the risk assessment are applied through risk management measures or techniques, this is referred to as Level 2 risk management.

Specific guidance on risk assessment, as used in the site restoration process, is provided in the document Guidance on Site Specific Risk Assessment for Use at Contaminated Sites in Ontario (May 1996b). That document provides information on both human health and ecological risk assessment and also contains a description of the risk management decision making process.

The SSRA and the administrative process which accompanies this approach are further described in section 7.

# Background approach

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## 5.0 Using the background approach

The background approach involves restoration of a site to ambient conditions as found in the natural environment, or to the levels which existed prior to site contamination. This approach may be used at any contaminated site. To facilitate the use of this approach the ministry has compiled and provided background soil criteria which may be used as surface soil criteria (Appendix 2, Table F). These soil criteria are organized by two land-use types: agricultural and all others. The category of all others includes parkland, residential, industrial and commercial land use.

The background criteria may also be used when:

- ▶ generic criteria for a particular land-use designation are not provided in Tables A – D (Appendix 2);
- ▶ the site has been identified as a potentially sensitive site, which requires use of criteria more protective than the generic criteria, and a proponent does not wish to undertake a site specific risk assessment (section 6.1).

If a proponent wants to use the background approach, and the required background criteria are not listed in Table F, background criteria for use at a site may be developed as described in section 5.1. This information should be provided to the ministry for review.

If a proponent determines that the background criteria provided in Table F are not appropriate for use at a site because of local or regional variation in geology etc., background criteria may be developed as described in section 5.1. This information should be provided to the ministry for review.

## 5.1 Background criteria

Where background criteria are not provided in Appendix 2, or when the background criteria provided with this guideline are not appropriate for use, a proponent may develop the criteria by undertaking a soil sampling and analysis program. This sampling program must be consistent with the method used for

## Background approach

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the development of the criteria provided in Table F of Appendix 2 and is outlined below.

The ministry's Ontario Typical Range (OTR) sampling program may be modified to assist with the derivation of background criteria. The OTR program was initiated in 1991 to determine background concentrations for a variety of land uses and receptor categories. A full description of the OTR program is provided in Ontario Typical Range of Chemical Parameters in Soil, Vegetation, Moss Bags and Snow (MOEE, 1993).

To establish local background conditions, a sampling program requiring sample collection from not less than 30 separate sampling sites from at least 10 different geographical locations must be completed. A minimum of two replicate samples must be taken at each of the 30 (or more) sample sites. The sample sites must be in areas which have not been affected by local point sources of air or land pollution, by local roads or highways, or by other known sources of contamination. The sampling program should also avoid areas with unusually high natural levels of contamination. These locations may be in rural (agricultural land use) or urban (all other land uses) settings in Ontario. Suitable sites include parks, school yards, cemeteries, forests, wood lots, or large undeveloped areas.

The sampling and analysis program is used to establish the 90<sup>th</sup> percentile of the analytical concentration of the chemical(s) present in the soil and this value becomes the local background criterion for that chemical. There are two differences between the method used to establish local background and the method used in the generating the background criteria for this guideline. These differences are: (1) the 98<sup>th</sup> percentile is used for establishing provincial background criteria; and (2) two coefficients of variation are added to the 98<sup>th</sup> percentile.

The 90<sup>th</sup> percentile is used for establishing local background concentrations because a smaller number of sample sites and locations are used in sample collection. If the analytical results show large variability, increased replicate sampling (ie. more than two replicate samples) and averaging of the analytical results from the replicate samples may be used to establish the 90<sup>th</sup> percentile.

## Background approach

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Background criteria which are developed using this methodology cannot be used for site restoration if they exceed the criteria provided in Table A (Appendix 2) which are based on health effects. This upper concentration limit was also used in applying the coefficient of variation to the 98<sup>th</sup> percentile in the ministry's development of the background criteria provided in Table F (Appendix 2).

In areas of known widespread soil contamination, where a sampling program is planned and it is not possible to avoid the influence of historical, industrial emissions on the soil surface, the sampling program must be designed to determine the change in contaminant concentration as it varies with depth from the surface. A sampling program which establishes the variation in contamination from the surface to the subsurface area will better reflect the soil conditions of the area. This will serve to establish restoration targets which are consistent with the change in contaminant concentrations as they vary with depth.

The ministry's publication Ontario Typical Range of Chemical Parameters in Soil, Vegetation, Moss Bags and Snow (MOEE, 1993) provides additional guidance on sampling and analysis procedures for proponents to use when developing background criteria.

## Generic approach

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### 6.0 Using the generic approach

This section provides an explanation of the generic approach and of the decisions required to use the options available within the generic approach. The criteria associated with the generic approach are listed in Tables A to D (Appendix 2). Section 6.7 provides an outline of the process used to develop the generic soil, groundwater and sediment criteria provided in this guideline.

It should not be assumed that: analysis for all the criteria provided in Appendix 2 is necessary in any or all cases; analysis for the full suite of chemical parameters listed in Appendix 2 would constitute full characterization of a site; or, analysis for a suspected chemical may be ignored if the chemical is not listed in Appendix 2.

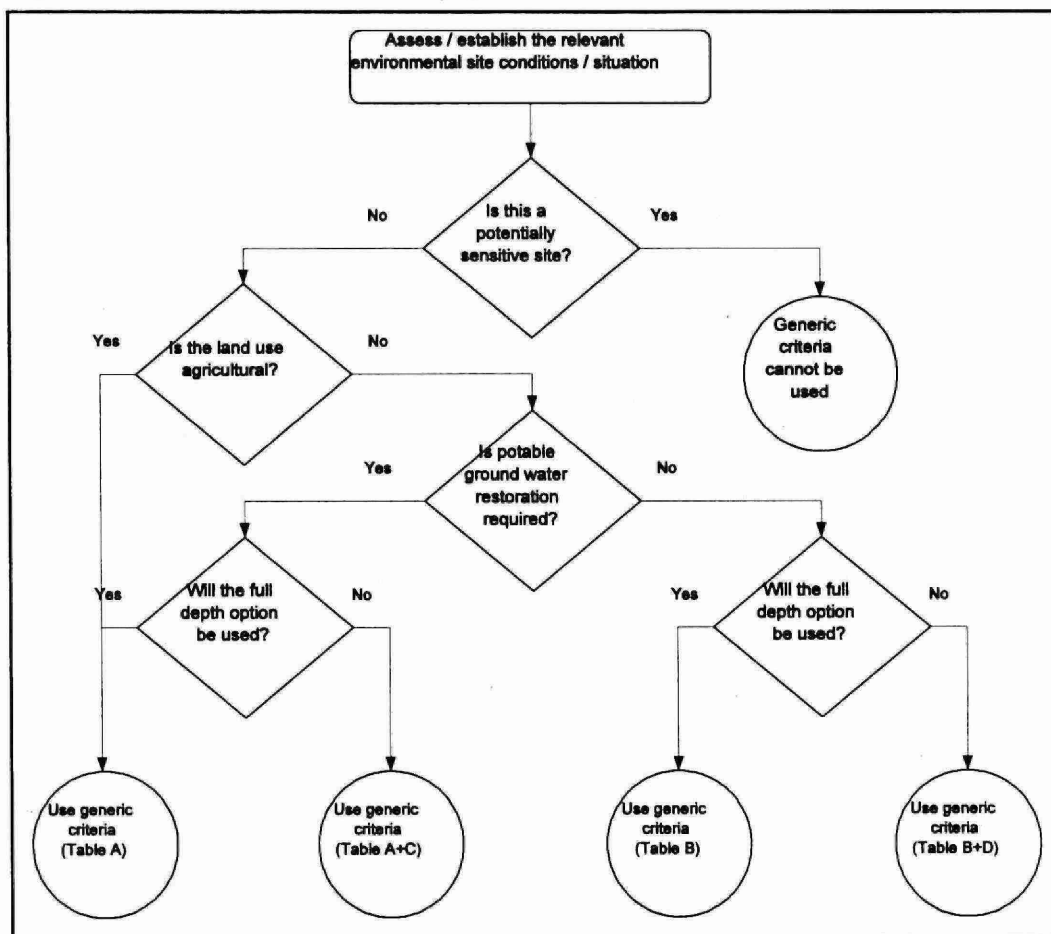
There are four questions which serve to guide a proponent in selecting the appropriate generic criteria. The terminology associated with each of these questions is explained in the following sections. These questions must be answered to arrive at the appropriate set of criteria for either soil or groundwater restoration. In addition, criteria are provided for fine and coarse textured soils for some of the chemical parameters listed in Tables A to D. An explanation of the relationship between the criteria and soil texture is provided in Section 6.4

1. Is this a potentially sensitive site? (section 6.1)
2. What is the intended land use? (section 6.2)
3. What type of groundwater restoration is required? (section 6.3)
4. Which depth of soil restoration will be used? (section 6.4)

Figure 6a provides a decision tree which illustrates how the answers to these questions lead to the appropriate generic soil and groundwater criteria.

# Generic approach

Figure 6a: Decisions for selecting generic criteria



- <sup>1</sup> use Table F (background criteria) or conduct ecological risk assessment / site specific risk assessment when generic criteria cannot be used.

## Use of the generic criteria

The soil and groundwater cleanup criteria presented in Tables A to D of Appendix 2 have been developed to provide protection against the potential for adverse effects to human health, ecological health and the natural environment in a variety of exposure scenarios associated with typical site and groundwater uses. The criteria levels have also been established so that there will not be a

## Generic approach

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potential for adverse effects through contaminant transfer from soil to indoor air, from groundwater or surface water through release of volatile gasses, from leaching of contaminants in soil to groundwater, or from groundwater discharge to surface water. As such, when the generic criteria levels in Tables A-D and all conditions associated with their use at a site are met, adverse effects or the likelihood of adverse effects will have been ruled out.

However, the generic criteria do not provide this level of protection when conditions indicate that a site is potentially sensitive and must be assessed differently (section 6.1), or when stratified depth conditions are violated (material at depth brought to the surface).

Safety and structural concerns, such as the potential for explosive conditions, the potential for corrosive conditions, or the potential for creating an unstable condition for foundations also must be addressed when these conditions exist or may exist. Use of the generic criteria does not ensure that corrosive, explosive or unstable conditions will be eliminated, or may not exist at a site in future.

The generic criteria may be used in two different ways, depending on the land use associated with the contaminated site. Contaminated sites may:

- ▶ be subject to a change in use where the decision to change the land use has already been made;
- ▶ continue in the present use when a change in the land use is not being considered, or is not desired.

When a landowner has made the decision to undertake a change in land-use, and the site assessment process described in section 8 is being followed, the generic criteria represent conditions which, when achieved, will allow the site to be reused for the intended land-use without concern for adverse effects.

When contamination is found at a site where a change in land-use is not planned, the generic criteria may be used to assist in making decisions about adverse effects and the need for restoration. This is somewhat different from the previously described situation where a decision to change the land-use has



## Generic approach

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already been made and the level of restoration required to rule out the potential for adverse effects is established by the new land use.

Decisions on the need to undertake restoration action when the generic criteria are exceeded, and where the land use is not changing, require an examination and consideration of factors such as:

- ▶ the demonstrated presence or likelihood of an adverse effect (on and off property);
- ▶ an understanding of the type of protection provided by the generic criteria gained through knowledge of the exposure pathways and receptors which were considered in the development of the generic criteria, and through understanding how that combination of pathways and receptors relate to those which could be found at the site;
- ▶ an understanding of the quantitative relationship between dose and health response for sensitive receptors from all exposure pathways, including the safety and uncertainty factors which have been used in the development of the generic criteria;
- ▶ an understanding of the environmental characteristics of the contaminant (i.e. environmental fate and mobility) and of the site conditions which could influence the migration of the contaminant and its exposure and response characteristics (e.g. soil type, proximity to water table, depth to bedrock, etc.).

In each case, the decision to undertake or not undertake restorative action should entail an assessment and understanding of these and possibly other factors which can not be universally identified or quantified in this guideline.

When the decision is made that restorative action is needed, the generic criteria can be used as restoration targets or goal values. The choice of using the background approach or site specific risk assessment approach also remains available for the proponent's consideration.

## Generic approach

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There may be site conditions and characteristics which are very different from the conditions and assumptions used in developing the generic soil and groundwater criteria. There may be unique, highly sensitive receptors, at or in the vicinity of a site, which were not considered in the development of the generic criteria and therefore make those criteria inappropriate for use. Section 6.1 provides information on dealing with potentially sensitive sites as considered in this guideline.

# Generic approach

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## 6.1 Is this a potentially sensitive site?

For the purpose of this guideline, potentially sensitive sites are those which meet any of the following conditions, and includes the subject site and any affected site(s).

- i. The contaminated site includes, or there is a potential for it to have an adverse effect on, any one of the following:
  - a) a provincial nature reserve established under the Provincial Parks Act (R.S.O. 1990) by Ministry of Natural Resources (MNR).
  - b) an area identified in resource management plans or inventory reports and zoned as a nature reserve zone by MNR.
  - c) a provincially or regionally significant area of natural or scientific interest (ANSI) designated by MNR.
  - d) a local environmentally sensitive area identified by a municipality, a conservation authority or other non-provincial body.
  - e) a fish habitat identified by MNR, acting as Environment Canada's agent, under the Fisheries Act. (R.S.C. 1985, Chap F-14 as amended)
  - f) a habitat of vulnerable, threatened or endangered species of birds, wildlife, fish or plants as listed by MNR.
  - g) a wetland identified as being significant by any planning jurisdiction.
  - h) a provincial park as designated by MNR under the Provincial Parks Act.
- ii. Site conditions are such that there are less than two metres of overburden and soil overlying the bedrock in the contaminated areas of the site, or in the contaminant plume area hydraulically down gradient of the source of the contamination. This site condition will invalidate the assumptions used in the contaminant leaching models used to develop the generic criteria.

## Generic approach

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- iii. Inorganic chemical parameters on the site exceed background concentrations (Table F) and soils have a pH (in 0.01 M CaCl<sub>2</sub>) less than five or greater than nine for surface soils or greater than 11 for subsurface soils.

For potentially sensitive sites with attributes listed under (i), consultation with the appropriate agency (e.g. local MNR office, conservation authority, or local municipality) should be undertaken to ensure that the generic criteria will provide adequate protection. If the consultation indicates that more protective ecological criteria are needed, or if the generic criteria for the chemical parameter of concern does not include an ecological component, then background criteria should be used, or the ecological component of the generic criteria should be adjusted or developed through an ecological risk assessment (ERA).

Table F in Appendix 2 provides background criteria for certain chemical parameters. Proponents are referred to the Rationale for the Development and Application of Generic Soil, Groundwater, and Sediment Criteria for Use at Contaminated Sites (May 1996c) to determine if an ecological component was considered in the development of generic criteria for the chemical parameter(s) of concern.

The purpose of requiring an ERA is:

- ▶ to encourage restoration to healthy conditions, where the quality and integrity of ecosystems, including air, water, land and biota have been diminished; or
- ▶ to ensure that restoration of the contaminated site does not create an adverse effect for the identified sensitive natural features on or near the site.

If the site meets condition (ii) a modification of the soil and groundwater criteria would be required to adjust the leaching component which was developed with contaminant transport models and use of dilution factors which rely on the presence of a soil and overburden layer of at least two metres.

## Generic approach

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Condition (iii) is meant to address the potential for the increased effect of inorganic contaminants on terrestrial ecological receptors and on groundwater as solubility, availability and mobility increase with changes in pH.

If conditions (i), (ii) or (iii) apply to the site, restoration to background levels may be undertaken, or an SSRA may be used to modify the generic criteria. Additional guidance on this type of SSRA may be found in section 7, and in Guidance on Site Specific Risk Assessment for Use at Contaminated Sites in Ontario (May 1996b). The need for consultation with the municipality would not apply to this type of SSRA. However, a peer review of the report does have to be completed before it is submitted to the ministry for review. The local MOEE district office, in consultation with the Standards Development Branch, will provide additional guidance when needed, on how this criteria modification should be best undertaken.

## 6.2 What is the intended land use?

Land use types are usually designated in an official plan or zoned as agricultural, residential, parkland, industrial or commercial. The soil and groundwater criteria provided in this guideline have been organized to reflect the following groupings:

- ▶ Agricultural (A)
- ▶ Residential/Parkland (R/P)
- ▶ Industrial/Commercial (I/C)

Institutional uses such as schools, daycare centres and hospitals should be included in the R/P category. If any portion of an industrial or commercial site includes residential occupancy, a playground, open space, or a daycare the site should be considered to be in the R/P category. This is consistent with the assumptions and the exposure scenarios considered in developing the criteria.

### Mothballing contaminated sites

Ideally, contaminated sites which are being taken out of service and mothballed, such as a retail fuel outlet, should be restored to levels which correspond to the appropriate land-use category noted above, based on the proposed official plan or management plan land-use designation or zoning. When a proponent chooses not to restore the site, measures should be put in place to restrict public access, and to ensure that environmental condition of the site will not cause, or is not likely to cause an adverse effect to human health, ecological health or the natural environment. The person responsible may consider using one or more of the following to restrict access to the site:

- i. warning signs;
- ii. fencing;
- iii. maintaining security and/or surveillance.

Landowners may also consider providing notification of the restricted site conditions to the municipality and/or local fire department. It is the responsibility of the owner, occupant of a property or other person responsible to ensure that site conditions comply with applicable statutes and regulations.

## Generic approach

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### 6.3 What type of groundwater restoration is required?

Criteria are provided for the restoration of impaired groundwater to potable and nonpotable conditions (Table A/Table B, Appendix 2). These criteria are to be used when groundwater quality has been degraded because of a spill, leak or other discharge of a contaminant, and remedial action is required.

Restoration of groundwater quality to either potable or nonpotable levels ensures the following:

- ✓ protection against exposure from vapours which may migrate to indoor air (basements) from volatile chemicals in groundwater;
- ✓ protection for aquatic receptors in surface waters which could be affected by the discharge of groundwater.

In addition to the levels of protection noted above, restoration of groundwater to potable levels ensures:

- ✓ protection of groundwater as a source of drinking water for human health criteria and for aesthetic guidelines.

Further explanation of how these levels of protection have been developed is provided in Section 6.7.

The following guidance must be used by proponents making decisions about the level of groundwater restoration required at a site.

## Generic approach

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Groundwater restoration to nonpotable levels may be considered only when **all** of the following conditions are met:

- i. area is already served by a communal or municipal drinking water supply which does not rely on the local groundwater;
- ii. present or future surface water or groundwater sources of drinking water will not be adversely affected, including water for agricultural and aquaculture uses;
- iii. the proponent has notified the municipality of the proposal to use criteria which would restore groundwater to nonpotable levels.



## Generic approach

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The reason for condition (i) is to ensure that existing private water supplies will not be adversely affected if restoration does not take place to potable levels.

The reason for condition (ii) is to ensure that the quality of existing or future potential communal or municipal water supplies will continue to meet the limits prescribed in the Ontario Drinking Water Objectives (MOEE, 1994c) if a potable level of restoration does not occur. Potential for degradation of water being used for irrigation, aquaculture or other uses more sensitive than drinking water must also be considered.

The reason for condition (iii) is to ensure that the municipality is aware of the proposed groundwater restoration to nonpotable levels and has an opportunity to raise concerns, if any, with the proponent.

The following reference is provided for those needing additional information on irrigation water quality as noted in condition (ii) above.

Fact sheet: Water Quality for Greenhouse Crops. Ministry of Agriculture and Food (1987), Blom, T., Straver, B., Brown, W., and Hughes, J., AGDEX 290/15

The ministry has recently updated its objectives for drinking water quality. These can be found in Ontario Drinking Water Objectives (MOEE 1994c). The chemical parameters provided in the provincial drinking water objectives are not all listed in Table A of this guideline. The levels of protection provided by the drinking water objectives may be different from those listed in Table A of this guideline for potable groundwater.

In most cases the drinking water values are the lowest of the three values which make up the leaching component and thus become the potable groundwater criteria (see Figures 6b and 6c). In some instances, one of the other two values which make up the leaching component is lower than the drinking water value. In these instances potable groundwater criteria will be lower than the drinking water value.

When establishing groundwater criteria it is necessary to consider protection against vapour movement from groundwater and to provide protection of

surface water from the discharge of contaminated groundwater. When these scenarios are considered, the Table A criterion will be numerically lower than the Ontario Drinking Water Objective. Section 6.7 provides additional information on the different components considered in the development of the groundwater criteria.

Proponents are advised to refer to the drinking water quality objectives when guidance is required for chemical parameters not listed in Table A. Proponents are also advised to refer to the Rationale for the Development and Application of Generic Soil, Groundwater, and Sediment Criteria for Use at Contaminated Sites (May 1996c), for a detailed explanation of the rationale for the groundwater criteria presented in this document, including an explanation of the levels of protection provided by these criteria.

## Generic approach

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### 6.4 Which depth of soil restoration will be used?

Proponents may generally select one of two options for the depth of soil restoration to take place at a site. When the vertical extent of the contamination extends more than 1.5 metres below the final site grade, the proponent may choose to do either a full depth restoration or a stratified restoration. Full depth restoration means that soil quality is restored for the full vertical and lateral extent to which contamination is found at the site.

A stratified restoration involves use of two different sets of criteria at a site. For each chemical parameter of concern, one criterion is used for soil at and above 1.5 metres and another is used for soil below 1.5 metres. This condition is referred to as a stratified site condition. For a stratified site condition, the quality of the soils at and above 1.5 metres should not exceed the criteria provided in Table A or B, and the quality of the soils below 1.5 metres should not exceed the levels provided in Table C or D. When a stratified site condition exists at a site, the subsurface soils must remain at a depths greater than 1.5 metres. If subsurface soils are brought to and left at surface, or within 1.5 metres of the surface, further management of these soils will be required.

The 1.5 metre mark, which establishes the depth above and below which different criteria may be used, is measured from the final grade elevation excluding the thickness of any non-soil surface treatment such as asphalt, concrete, aggregate, etc..

Three generic criteria components were examined when the surface soil criteria were developed. These are the soil ingestion/dermal contact component, the terrestrial ecological protection component and the soil vapour to indoor air component. Exposure scenarios for soil ingestion/dermal contact, which estimate the effect of the chemical on human health, have been adjusted to reflect the changes in frequency and intensity of exposure likely to be associated with different site uses (i.e. residential, commercial) and soil accessibility. The terrestrial ecological component and the soil vapour to indoor air component were not applied to subsurface soils.

The generic criteria for surface and subsurface soil were developed to provide protection against the potential for vapour movement to indoor air (basement)

if vapour is emanating from contaminated groundwater or contaminated soil in close proximity to a basement. Potential vapour movement from contaminated soil or groundwater will not adversely affect air quality when living space is located above or below the 1.5 metre level if the generic soil quality criteria are met. An additional 1.5 metre envelope of surface soil quality is not required below a basement floor.

### Soil texture

Criteria for some of the organic and inorganic parameters listed in Tables A to D have different values for coarse and fine textured soil/overburden. Texture influences the availability of, or the ease with which plants and animals will take in, contaminants which have adhered to soil particles. Contaminants which adhere to coarse material are usually more available for uptake than those which adhere to fine textured material. The numerical values of the criteria for coarse materials, therefore, tend to be smaller than those for fine materials.

Coarse textured soil/overburden is defined as material having greater than 70 percent (by dry weight) particles equal to or larger than  $50\mu$  diameter (sand). Materials with less than 70 percent sand-sized particles are medium/fine textured.

The generic criteria for coarse textured material must be used if a laboratory texture analysis has not been completed, unless the texture can be easily and clearly distinguished from a field examination. A sieve analysis is usually used to accurately determine the particle size fractions, and to allow selection of the appropriate criteria based on texture. At some sites there may be significant lateral and vertical differences in the texture. Normally, when greater than 2/3 of the soil/overburden (surface to bedrock) is of a particular type, the site will be composed of that type of material. However, consideration should be given to choosing the most permeable material at a site (even if less than 2/3) in situations where migration of contaminants from the site could be affected by the location of this material at the site.

### Soil pH

## Generic approach

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The generic criteria are meant to be used when surface soil pH falls between five and nine, and when the pH of overburden at depth (greater than 1.5 metres) falls between five and 11. When the pH is beyond these ranges, contaminant mobility may be affected and will require further investigation.

# Generic approach

## 6.5 Summary of generic criteria tables

Tables 6a and 6b summarize the relationship between the guideline criteria tables presented in Appendix 2 and the variables of land use, type of groundwater restoration and depth of soil restoration discussed in the previous sections.

Table 6a: Generic criteria for full depth restoration

	Soil and groundwater criteria by land use and existing or future groundwater use						
Full depth condition	Ag soil	Res\Park soil	Ind\Com soil	Potable groundwater	Res\Park soil	Ind\Com soil	Nonpotable groundwater
from surface to depth of contamination	Table A				Table B		

Table 6b: Generic criteria for stratified depth restoration

	Soil and groundwater criteria by land use and existing or future groundwater use						
Stratified condition	Ag soil	Res\Park soil	Ind\Com soil	Potable groundwater	Res\Park soil	Ind\Com soil	Nonpotable groundwater
from surface to 1.5 m below surface	Table A				Table B		
below 1.5 m to depth of contamination	Table C				Table D		

# Generic approach

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## 6.6 Development of the generic criteria

This section provides an overview of the process used to develop the generic guideline criteria. An extensive set of generic criteria for 117 organic and inorganic chemical parameters is provided with this guideline for use when the generic approach is selected for use at a contaminated site. Section 6.7 provides options for development of new criteria when the chemical of concern identified at a site is not listed in the criteria tables which accompany this guideline.

It should not be assumed that: analysis for all the criteria provided in Appendix 2 is necessary in any or all cases; analysis for the full suite of chemical parameters listed in Appendix 2 would constitute full characterization of a site; or, analysis for a suspected chemical may be ignored if the chemical is not listed in Appendix 2.

Generic criteria for soils and groundwater have been developed to protect human health, ecological health and the natural environment under a range of exposure scenarios related to three common land-use groupings, two groundwater uses, two contaminant depth scenarios and two soil textures as described in Section 6.2, 6.3 and 6.4. The development of the numerical criteria was based in part on consideration of the following:

- ▶ direct and indirect pathways of exposure to both human and ecological receptors (terrestrial and aquatic);
- ▶ consideration of environmental fate and movement of the contamination;
- ▶ assumptions about likely exposure pathways to sensitive receptors.

Groundwater criteria were developed for restoration to both potable and nonpotable levels. The potable criteria protect groundwater as an existing or future drinking water source, protect against adverse effects from potential movement of vapours from the groundwater to indoor air, and protect against adverse effects to aquatic species from contaminants in groundwater being discharged to surface water bodies.

## Generic approach

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The nonpotable criteria provide protection against potential adverse effects from vapour migrating to indoor air and protection against potential adverse effects to groundwater discharging to surface water. This information is summarised in Table 6e.

The generic criteria for soil have also been developed to ensure that ambient air quality and groundwater quality criteria will not be exceeded if there are contaminant vapours or if there is contaminant leaching from the soil. These criteria will also prevent the likelihood of indoor air contamination from soil vapour movement. Soil vapour to outdoor air, soil contamination to groundwater, soil vapour to indoor air, and groundwater vapour to indoor air models were used to develop these levels of protection.

A detailed description of the process used to develop the generic criteria is available in the Rationale For the Development and Application of Generic Soil, Groundwater, and Sediment Criteria for Use at Contaminated Sites in Ontario (May 1996c).

### Ceiling concentration limits

The generic criteria concentrations, which were developed to be protective of human and ecological health and the natural environment, are restricted in value by established concentration limits. These are referred to as ceiling concentrations and are used to deal with the potential for odour/taste concerns and to place a limit on the maximum concentration value of the health-based criteria. This limit will minimize the potential for continued deterioration of soil and groundwater quality in Ontario, recognizing that once contaminated, it may not be possible or feasible to restore these media to ambient or background levels. It also provides a level of protection for routes of exposure which were not included in the generic criteria component process, such as direct ingestion from consuming food grown in restored soil, inhalation of soil particles and bioaccumulation of contaminants in animals grazing on restored soil.



# Generic approach

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## Analytical detection limits

The generic criteria concentrations were compared with analytical detection capabilities of laboratories and with provincial background soil quality levels. This was done to ensure that the generic criteria would not be set below analytical limits or background levels. The numerical value for a chemical parameter may be adjusted upward because the human/ecological health value is numerically lower than the analytical detection limit or the background concentration. This amounts to a change from the human/ecological health risk target level, or from the percentage of the total tolerable intake allocated to that receptor's exposure pathway used in the development of the generic criteria.

## The component process

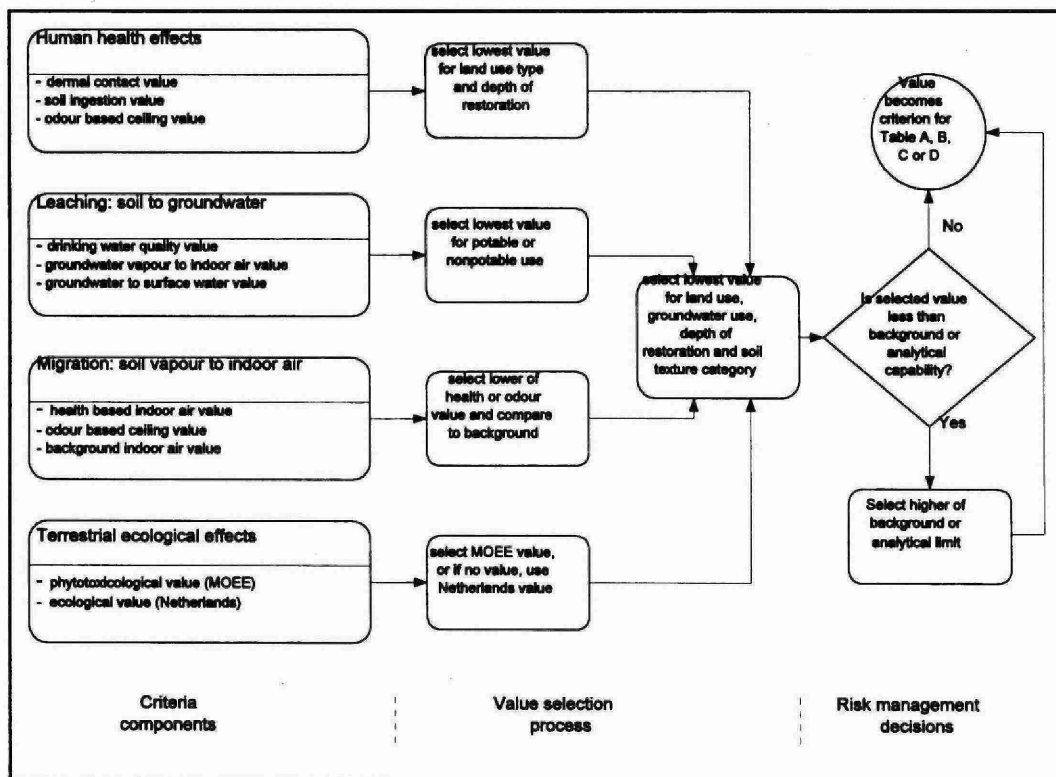
Figures 6b and 6c provide an overview of the process used in the development of the generic soil and groundwater criteria. The criteria components, the value selection process and the some of the risk management decisions are briefly described. Additional discussion of the risk management decisions is provided in section 7.1. The process outlined in these figures was used in the selection of criteria for each of the land use and groundwater use categories.

Tables 6c, 6d, and 6e provide a more detailed list the receptors and routes of exposure (pathways) considered in the development of the majority of the soil and groundwater criteria. The process outlined in Figures 6b and 6c is used in conjunction with the marked components from Tables 6c, 6d and 6e for each scenario (land use, restoration depth, groundwater use). Table 6c provides information on the development of agricultural and residential/parkland soil criteria. Table 6d provides information on the development of industrial/commercial soil criteria and Table 6e provides information on the development of potable and nonpotable groundwater criteria.

The receptors and pathways considered in the development of the generic criteria have been divided into three component groups to illustrate the way in which the criteria were developed. At the top of tables 6c and 6d is a listing of the land use, the depth of restoration, the type of groundwater restoration, and the table of Appendix 2 where the actual criteria for that site condition are

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Figure 6b: Overview of generic soil criteria selection process



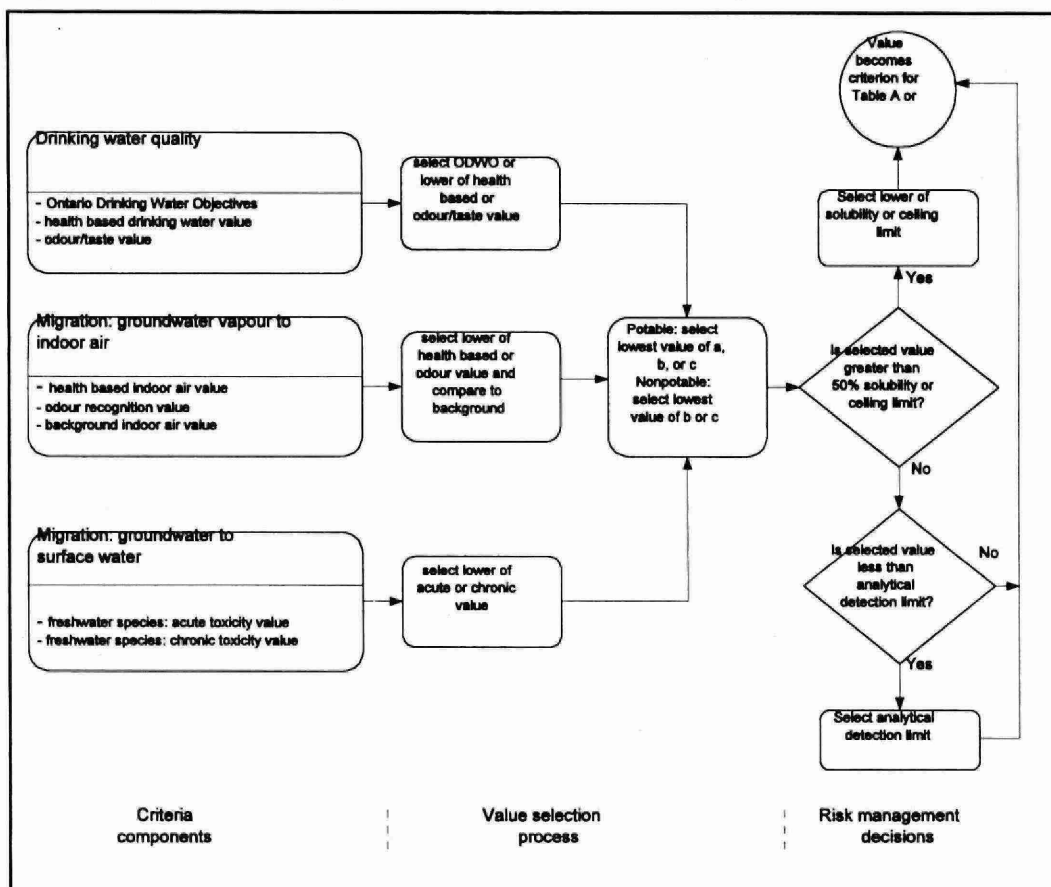
listed (Tables A, B, C or D). Table 6e lists the potable and nonpotable groundwater categories at the top.

Tables 6c, 6d and 6e are read by establishing the appropriate category of interest at the top of the table (land use, restoration depth and groundwater restoration). By reading down the column for the appropriate category one can see the exposure routes, exposure effects, or risk management variables which were included in the development of those criteria. These are marked with a ✓.

Component group A is a listing of the direct and indirect pathways, receptors, and the risk-based effects considered in the generic criteria development. The human or ecological receptor is noted in parentheses. The S1, S2 and S3 notations relate to soil categories used by the Commonwealth of Massachusetts and are part of an approach which has been adopted and modified for use in

# Generic approach

Figure 6c: Overview of groundwater criteria selection process



Ontario. A complete explanation of these categories is provided in the Rationale for the Development and Application of Generic Soil, Groundwater and Sediment Criteria for Use at Contaminated Sites in Ontario (MOEE 1996c).

Component group B is a listing of additional effects and/or ceiling concentrations considered in the development of the generic criteria which are not based on health risk, but which do provide protection against different types of effects. The boundaries established by these components serve as limits to a potential effect which is not health based.

## Generic approach

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Component group C is a listing of Level 1 risk management variables considered in the development of the generic criteria. These are the variables which serve as limiting elements in the process. An explanation of how the decisions are made in selecting values from the different component groups is provided below.

Use of this component process incorporates the flexibility required to provide criteria for the different land use, groundwater, and soil restoration options previously described. The only exceptions to the use of this component approach are cases where the component values had not been developed, or where additional research effort is required. These are noted in the ministry rationale document (May 1996c).

The following is an explanation of how the component process is used in the selection of generic soil and groundwater criteria, and assists in understanding which exposure and receptor components influence the numerical value of the criteria. This process is illustrated in Figures 6b and 6c.

- ▶ the criteria are arrived at by selecting the lowest value from all of the marked components (✓) in groups A and B.
- ▶ if the selected value from groups A and B is greater than that for any marked component from group C, then the lowest value from groups A or B becomes the criterion.
- ▶ if the selected value from groups A and B is less than any marked group C component, then the greater of the marked group C components becomes the criterion value.

Table 6e shows that the only difference in the components considered for the potable and nonpotable criteria is that of human health effects (drinking water). All other group A, group B and group C components were considered in the development of the potable and nonpotable groundwater restoration criteria.

# Generic approach

Table 6c: Considerations in the development of generic criteria for agricultural and residential/parkland soils

COMPONENTS USED IN THE DEVELOPMENT OF SOIL QUALITY CRITERIA	Land use ⇒	Ag	Residential/parkland					
	Cleanup depth ⇒	F	F		S		SS	
	Groundwater ⇒	P	P	N P	P	N P	P	N P
	Table A,B,C, or D ⇒	A	A	B	A	B	C	D
<b>COMPONENT GROUP A</b>								
Dermal contact/ingestion (human health) High exposure/accessible soils (S1)		✓	✓	✓	✓	✓		
Dermal contact/ingestion (human health) Moderate exposure/accessible soils (S2)							✓	✓
Dermal contact/ingestion (human health) Limited exposure/restricted access (S3)								
Ecological effects - direct contact (plants/microbes)		✓	✓	✓	✓	✓		
Ecological effects (bioaccumulation/grazing animals)		✓						
Leaching to gw - potable quality (human health)		✓	✓		✓		✓	
Leaching to gw - vapour movement from gw to indoor air (human health)		✓	✓	✓	✓	✓	✓	✓
Leaching to gw - discharge to surface water (aquatic organisms)		✓	✓	✓	✓	✓	✓	✓
Vapourizing to ambient air (human health)		✓	✓	✓	✓	✓		
Vapour movement from soil to indoor air (human health)		✓	✓	✓	✓	✓		

Ag = Agricultural  
S = Surface  
✓ = was considered

F = Full  
SS = Subsurface

P = Potable (drinking)  
NP = Nonpotable

## Generic approach

Table 6c cont'd: Considerations in the development of generic criteria for agricultural and residential/parkland soils

COMPONENTS USED IN THE DEVELOPMENT OF SOIL QUALITY CRITERIA	Land use ⇒	Ag	Residential/parkland					
	Cleanup depth ⇒	F	F		S		SS	
	Groundwater ⇒	P	P	N P	P	N P	P	N P
	Table A,B,C or D ⇒	A	A	B	A	B	C	D
<b>COMPONENT GROUP B</b>								
S1 Soil ceiling - odour based - low volatiles		✓	✓	✓	✓	✓		
S2 Soil ceiling - odour based - high volatiles							✓	✓
S2 Soil ceiling - odour based - moderate volatiles							✓	✓
S2 Soil ceiling - odour based - low volatiles							✓	✓
S3 Soil ceiling - odour based - high volatiles								
S3 Soil ceiling - odour based - moderate volatiles								
S3 Soil ceiling - odour based - low volatiles								
<b>COMPONENT GROUP C</b>								
Rural background soil quality		✓						
Urban background soil quality			✓	✓	✓	✓	✓	✓
Analytical capability (MDL/PQL)		✓	✓	✓	✓	✓	✓	✓

Ag = Agricultural

S = Surface

✓ = was considered

F = Full

SS = Subsurface

P = Potable (drinking)

NP = Nonpotable

# Generic approach

Table 6d: Considerations in the development of generic criteria for industrial/commercial soils

COMPONENTS USED IN THE DEVELOPMENT OF SOIL QUALITY CRITERIA	Land use →	Industrial/commercial					
	Cleanup depth →	F		S		SS	
	Groundwater →	P	N P	P	N P	P	N P
	Table A,B,C or D →	A	B	A	B	C	D
<b>COMPONENT GROUP A</b>							
Dermal contact/ingestion (human health) high exposure/accessible soils (S1)							
Dermal contact/ingestion (human health) moderate exposure/accessible soils (S2)	✓	✓	✓	✓			
Dermal contact/ingestion (human health) limited exposure/restricted access (S3)						✓	✓
Ecological effects - direct contact (plants/microbes)	✓	✓	✓	✓			
Ecological effects (bioaccumulation/grazing animals)							
Leaching to gw - potable quality (human health)	✓		✓			✓	
Leaching to gw - vapour movement from gw to indoor air (human health)	✓	✓	✓	✓	✓	✓	✓
Leaching to gw - discharge to surface water (aquatic organisms)	✓	✓	✓	✓	✓	✓	✓
Vapourizing to ambient air (human health)	✓	✓	✓	✓			
Vapour movement from soil to indoor air (human health)	✓	✓	✓	✓			

F = Full

S = Surface

SS = Subsurface

P = Potable (drinking)

NP = Nonpotable

✓ = was considered

## Generic approach

Table 6d cont'd: Considerations in the development of generic criteria for industrial/commercial soils

COMPONENTS USED IN THE DEVELOPMENT OF SOIL QUALITY CRITERIA	Land use ⇒	Industrial/commercial					
	Cleanup depth ⇒	F		S		SS	
	Groundwater ⇒	P	NP	P	NP	P	NP
	Table A,B,C or D ⇒	A	B	A	B	C	D
<b>COMPONENT GROUP B</b>							
S1 Soil ceiling - odour based - high volatiles							
S1 Soil ceiling - odour based - moderate volatiles							
S1 Soil ceiling - odour based - low volatiles							
S2 Soil ceiling - odour based - high volatiles		✓	✓	✓	✓		
S2 Soil ceiling - odour based - moderate volatiles		✓	✓	✓	✓		
S2 Soil ceiling - odour based - low volatiles		✓	✓	✓	✓		
S3 Soil ceiling - odour based - high volatiles						✓	✓
S3 Soil ceiling - odour based - moderate volatiles						✓	✓
S3 Soil ceiling - odour based - low volatiles						✓	✓
<b>COMPONENT GROUP C</b>							
Rural background soil quality							
Urban background soil quality		✓	✓	✓	✓	✓	✓
Analytical capability (MDL/PQL)		✓	✓	✓	✓	✓	✓

F = Full

S = Surface

SS = Subsurface

P = Potable (drinking)

NP = Nonpotable

✓ = was considered



# Generic approach

Table 6e: Considerations in the development of generic groundwater criteria

COMPONENTS USED IN THE DEVELOPMENT OF GROUNDWATER QUALITY CRITERIA	Potable  Table A	Non potable  Table B
<b>COMPONENT GROUP A</b>		
Drinking water quality (human health)	✓	
Vapour movement from groundwater to indoor air (human health)	✓	✓
Groundwater discharge to surface water (aquatic organisms)	✓	✓
<b>COMPONENT GROUP B</b>		
Ceiling concentration in water (odour/taste)	✓	✓
Vapour movement from gw to indoor air (50% odour recognition)	✓	✓
<b>COMPONENT GROUP C</b>		
Analytical capability (MDL/PQL)	✓	✓
Vapour movement from groundwater to indoor air (indoor air background)	✓	✓
Ceiling concentration in water (50% of solubility)	✓	✓

### 6.7 Developing new generic criteria

This guideline provides soil and groundwater criteria for a number of inorganic and organic chemical parameters. There may be situations where a chemical is identified during a site assessment but is not listed in Appendix 2. In this situation, a proponent may choose to develop individual generic criteria or to adopt criteria from another jurisdiction as needed. In all cases, human health, ecological health and protection of the natural environment must be considered. The process used, including reference information, must be fully documented and submitted to the MOEE for review.

When the proponent decides to develop generic criteria, the methodology used in the development of Ontario's criteria for this guideline may be followed. Alternatively, the methodology described in the Canadian Council of Ministers of the Environment (CCME) document entitled A Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines (CCME, 1996) may be utilized. In some cases, no single protocol may be suitable for developing criteria for certain compounds, and alternate approaches, such as restoration to background levels, may have to be used.

### 6.8 Updates to criteria

As part of its mandate to ensure environmental protection, the ministry is involved in the ongoing review of standards for quality of air, land and water. The criteria provided in this guideline are based on the best information available to the ministry at the time of publication of this guideline.

Guideline criteria may be subject to adjustment as research advances and knowledge of health effects and the environmental fate of chemicals in soil, groundwater and sediment improves. Modifications to the generic criteria are subject to the public notification provisions outlined in the Environmental Bill of Rights (EBR) and/or to independent consultation. In all cases, the EBR Registry will be used to provide notification of changes to all ministry standards and criteria.

# SSRA approach

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## 7.0 The site specific risk assessment approach

The site specific risk assessment (SSRA) approach allows the incorporation of considerations which are specific to the site in the development of soil and groundwater criteria. This approach includes both risk assessment and risk management.

Risk assessment is the technical, scientific examination of the nature and magnitude of risk and uses a factual base to define the health effects of exposure of individuals or human and ecological populations to contaminants in different exposure situations. Risk assessment involves estimating the likelihood of an event and providing an expression of what that event might be. Protection of human and ecological health and of the natural environment must be considered when the site specific risk assessment approach is selected for use.

The SSRA approach may be used to:

- ▶ modify the human health or ecological components of a generic criterion through consideration of site specific exposure pathways and receptor characteristics;
- ▶ develop all human health or ecological components of a site specific criterion.

The human health and ecological components considered in the development of the generic criteria are listed in Tables 6c and 6d under the heading Component Group A.

Some of the variables which may be modified to reflect site conditions are:

- ▶ the models which estimate contaminant movement through soil, groundwater or to air;
- ▶ the soil/groundwater/hydrogeological characteristics used in the models;
- ▶ the groundwater dilution and attenuation factors used in the development of the generic criteria.

### Human health risk assessment

When using risk assessment in the site restoration process, all non-cancer as well as cancer endpoints must be considered in a human health risk assessment. Use of risk assessment requires knowledge and expertise from a wide range of specialists. Expert judgements and decisions are required throughout the process and must be fully documented to aid in the review of the assessment.

In a risk assessment, when only selected human health components of the generic criterion are being modified to reflect factors specific to the site, the remaining generic components (human and ecological) cannot be disregarded in the process of modifying the criteria (see Tables 6c, 6d and 6e). When modification of the components has been completed, all modified and unmodified components (human and ecological) must be compared. The site-specific criterion is determined by the most sensitive (lowest) component.

Where a component in the generic criterion development is missing, the possible effects of the proposed modification on the receptors relevant to the missing component/pathway should be evaluated. For example, modification of the direct contact component (human health) for a volatile chemical which does not also have the soil vapour to indoor air component (human health) or ecological component will involve an evaluation to rule out possible effects due to the soil vapour to indoor air pathway or on ecological receptors, respectively. This evaluation can be conducted through the use of site specific data, reference to scientific literature, and/or modelling.

At potentially sensitive sites, as described in section 6.1, the use of human health risk assessment may also be necessary to address site-specific situations where the movement of contaminants to groundwater cannot be adequately characterized by the assumptions made in the soil-to-groundwater contaminant movement model used in the development of the generic criterion.

The four elements of a human health risk assessment are:

- ▶ Hazard identification/problem formulation
- ▶ Toxicity assessment

## SSRA approach

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- ▶ Exposure assessment
- ▶ Risk characterization

Additional information on these elements of a human health risk assessment are provided in Guidance on Site Specific Risk Assessment for Use at Contaminated Sites in Ontario (1996b).

### Ecological risk assessment

Ecological risk assessment (ERA) is the technical and scientific assessment of the nature and magnitude of the risk attributable to the presence of a contaminant when considering the natural environment and its nonhuman components.

In an ERA, when the terrestrial and/or aquatic ecological components of a generic criterion are being modified to reflect site specific factors, the remaining components (human and ecological) stay fixed and cannot be disregarded in the criteria modification process (see Tables 6c, 6d and 6e).

At potentially sensitive sites, as described in Section 6.1, an ERA may be required to modify the components of the generic criteria to account for sensitive receptors or site conditions not considered in the process of developing the generic criteria.

The CCME (Gaudet et al., 1994) has established three levels of investigation for consideration when conducting an ERA. These are:

- ▶ Screening level assessment;
- ▶ Preliminary quantitative risk assessment;
- ▶ Detailed quantitative risk assessment.

Each level builds upon the existing data, knowledge, and decisions from the preceding level. If the initial level or tier of assessment does not adequately characterize the risk, then it will be necessary to use the next level of

investigation. When the level of an ERA is adequate for ecological risk management decisions to be made, the process should stop at that level.

The four elements of an ecological risk assessment are:

- ▶ Receptor characterization;
- ▶ Exposure assessment;
- ▶ Hazard assessment;
- ▶ Risk characterization.

Additional information on the details associated with these elements of an ecological risk assessment are provided in Guidance on Site Specific Risk Assessment for Use at Contaminated Sites in Ontario (May 1996b).

In addition to its use in the SSRA approach, ERA may be used in development of, or in adjusting, criteria for use at potentially sensitive sites. Both ERA and human health risk assessment should be used in the development of generic criteria when generic criteria are not available.

## 7.1 Risk management

Risk management refers to the development and implementation of a decision, strategy or technique to limit or manage the level of risk estimated by the risk assessment process. In some cases, the decisions are a part of and directly affect the scientific risk assessment process, while in other cases they are made in consideration of factors other than scientific factors. Depending on the nature of the risk management measures, further risk assessment may be necessary to assist in the evaluation of residual risks resulting from the use of these strategies or techniques.

This guideline distinguishes between two basic types of risk management decisions, termed Level 1 and Level 2 risk management.

# SSRA approach

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## Level 1 risk management

A number of risk management decisions have been made by the ministry in the development of the generic criteria provided in this guideline. When proponents use the SSRA approach, these decisions must be incorporated and are summarized below.

- ▶ use of ceiling concentrations in development of soil and groundwater criteria.
  - ▶ development of site specific criteria would not require the same ceiling concentrations used in the development of the generic criteria. However, use of an upper concentration limit (UCL) is a part of the SSRA approach. A full description is provided in the companion document Guidance on Site Specific Risk Assessment for Use at Contaminated Sites in Ontario (MOEE, 1996b)
- ▶ use of 50 percent water solubility limits.
- ▶ use of background soil concentrations as a lower concentration limit to ensure that criteria are not set below background levels.
- ▶ use of analytical detection limits as a lower concentration limit to ensure that criteria are not set below analytical capabilities.
- ▶ allocating 20 percent of the reference dose for each exposure pathway.
  - ▶ the 20 percent allocation for each pathway may be increased or reduced (Level 1 risk management decision). Any deviation from the 20 percent allocation level must be supported with a multimedia exposure assessment to reflect the site exposure conditions.
- ▶ use of an excess lifetime cancer risk of one in one million ( $10^{-6}$ ) for each exposure pathway for non-threshold parameters (carcinogens).
  - ▶ changing this risk level is considered a Level 2 risk management decision.

### Level 2 risk management

These types of decisions involve use of mechanisms or techniques for reducing, eliminating or blocking exposure pathways. Limiting the way in which a site is used, or limiting access from certain receptors, modifying the level of risk based on socio-economic or technical feasibility considerations, or using other mitigative measures designed to minimize the movement or uptake of contaminants by receptors are considered Level 2 risk management decisions.

### Level 2 risk management plan

Level 2 risk management decisions should be summarized in a risk management plan. The risk management plan must provide for, but need not be restricted to, the following:

- ▶ the source and nature of the adverse effect or potential for the adverse effect;
- ▶ the control measure(s) used to eliminate or reduce the adverse effect or potential adverse effect to acceptable levels;
- ▶ the exact nature of the monitoring and maintenance required, and a schedule for the monitoring and maintenance of the risk management measure(s);
- ▶ the person(s) responsible for, and financial arrangements for, ongoing monitoring and maintenance of the risk management measure(s);
- ▶ the person(s) to be notified, and the person(s) responsible for ensuring appropriate corrective action is undertaken, as required, to maintain the effective operation(s) of the risk management measure(s);
- ▶ the action(s) required should the responsible person(s) be unable to complete any of the above;



# SSRA approach

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- ▶ the source(s) and amount(s) of funding available to undertake corrective action(s) as required;
- ▶ the contingency provision(s) included in the design of the risk management measure(s);
- ▶ the institutional or administrative control(s) or agreement(s) which, if required, ensure that the risk management measure(s) is/are not subject to alteration without prior notification to the municipal or other local land-use authority. The ministry will not be a party to these agreements.

## 7.2 Administrative requirements

The administrative requirements for use of the SSRA approach are outlined in this section. Section 8.7 provides additional information on the use of the Certificate of Prohibition mentioned below.

Risk management may involve the use of strategies, controls or techniques to limit the movement of contaminants, and/or limit the potential for receptors to be exposed to contaminants. A proposal for a land-use change may incorporate risk management. A municipal approval or permit may be required for the construction and installation of a risk management control or technique.

The ministry will complete the technical review of risk assessments and/or risk management plans and provide comments when the SSRA approach is used.

The administrative requirements when using the SSRA approach are listed below.

- ▶ A community-based public communication program should be developed and implemented to provide the public with an opportunity to participate in the risk assessment process and in the development of the remedial plan (section 3).
- ▶ The proponent must confirm that use of the SSRA approach has been discussed with the municipality (city or other local public authority).

- ▶ A qualified, independent peer reviewer, one with no previous involvement with the site must review the documentation, including scientific references, scientific judgment and any identified areas of uncertainty associated with the risk assessment. Concerns identified through the peer review must be documented and resolved before the documentation is submitted for ministry review.

In addition to the requirements listed above, when Level 2 risk management measures are proposed, the risk management plan must also provide for the following:

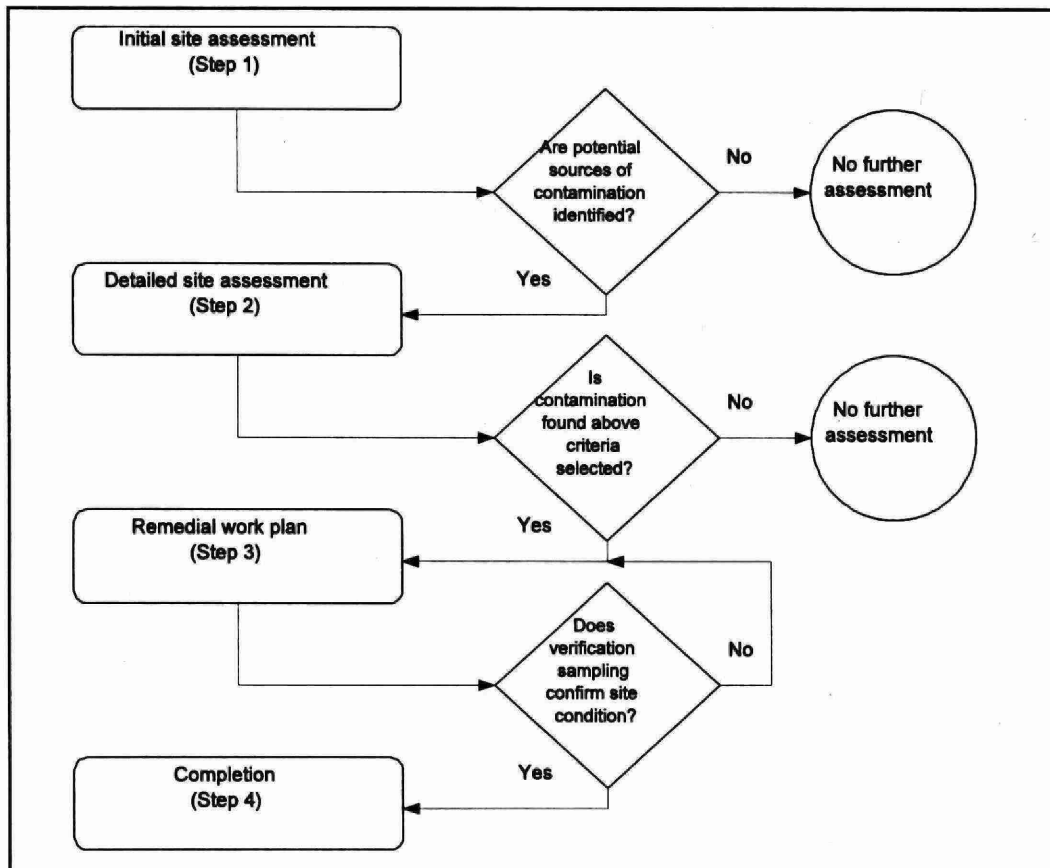
- ▶ Municipal controls may need to be established when Level 2 risk management (site management) includes provisions to limit receptor access or to block or mitigate exposure pathways. These controls are required to ensure that the site does not change in a way which would reduce the effectiveness of the control measures, or create pathways for receptors which were not considered in the risk assessment;
- ▶ After the ministry reviews and concurs with the findings of the risk assessment, and with implementation of the recommendations of the risk management plan, the registration of a Certificate of Prohibition on title to the land must be completed, if an order is issued requiring it to be registered;
- ▶ Procedures for ongoing monitoring and maintenance of any control measures;
- ▶ Procedures for ensuring corrective action will be taken in future, if and when it is required. Corrective action may include repair, replacement, or removal of the control measure, or of the substance posing the adverse effect if control measures fail to achieve the desired reduction/elimination of exposure levels.

# Site assessment

## 8.0 The site assessment process

This section provides four conceptual steps which outline the site assessment and restoration process. The four steps are illustrated in Figure 8a. This outline is not meant to be a comprehensive or exhaustive description of activities. The types and sequence of activities required at each step will necessarily vary with each site, its conditions, and the goals of the assessment, investigation or remedial exercise.

Figure 8a: Overview of the site assessment process



### 8.1 Step 1 - Initial site assessment

The first step in the site assessment process usually involves the systematic gathering of information to identify actual or potential contamination, or sources of contamination. This is referred to as a Phase 1 environmental site assessment (ESA). Figure 8b provides an outline of the elements of a Phase 1 ESA as described below.

#### Phase 1 environmental site assessment (ESA)

A reference list of published guidance manuals on Phase 1 ESA, with a brief overview of each of these documents is provided in Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario (1996a).

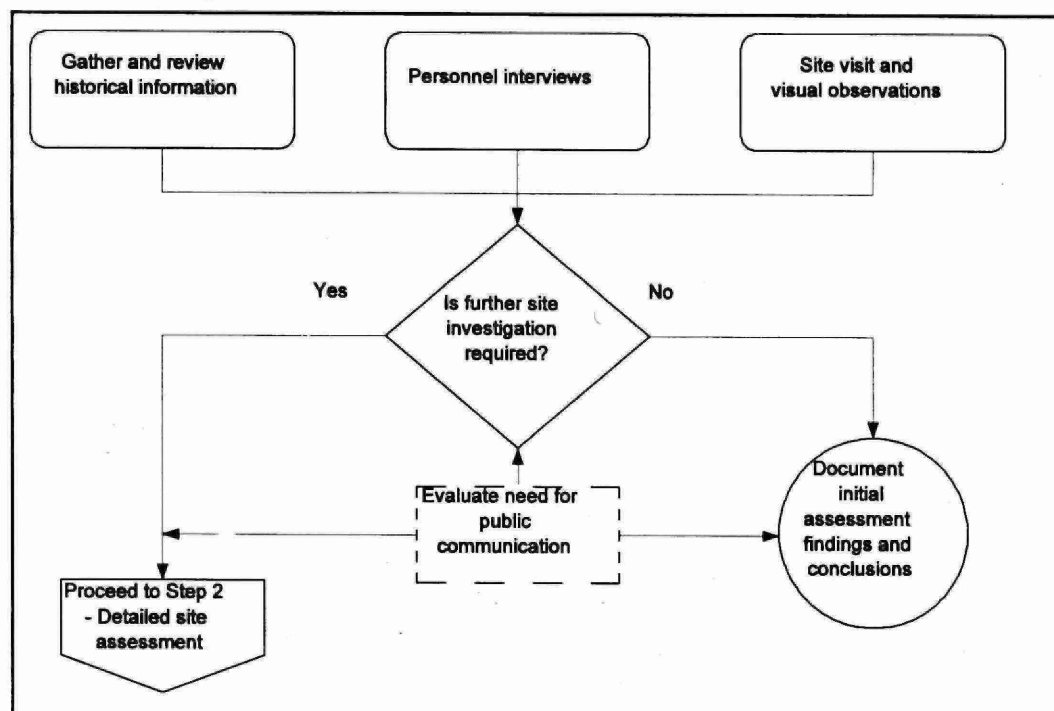
Proponents are referred to this summary for more detailed guidance on conducting a Phase 1 ESA.

A Phase 1 ESA may include, but is not limited to the following activities:

- ▶ reviews of property histories through the use of air photographs, insurance maps, land title searches, municipal or provincial archives, regulatory agency records, previous ESA reports, company records, topographic maps.
- ▶ interviews with present and past site occupants, government officials (federal, provincial and municipal), present and past neighbours.
- ▶ site visits to inspect material handling, waste management and storage practices, to investigate for presence of polychlorinated biphenyl (PCB), or asbestos-containing materials (ACM), or to examine building heating and cooling systems and fuel storage locations at operating facilities.
- ▶ site visits to verify any of the findings or discrepancies noted in the review of historical information or interview process.
- ▶ geomagnetic or geophysical surveys to gather information for directing subsequent sampling programs.

# Site assessment

Figure 8b: Step 1 – Initial site assessment



The result of a Phase 1 ESA determines the need for further site investigation. Since soil and groundwater samples are not normally collected in a Phase 1 ESA, the importance of accurate and comprehensive gathering of historical site information is critical. This historical information will normally direct the need for any further investigative activities at the site.

A Phase 1 ESA will provide an indication of the need for, and the type of, sampling and analysis required, or it may indicate that the site (soil, sediment, ground/surface water) and/or building(s) are free of contamination and that further investigation is not necessary. If there is evidence of, or reason to suspect, presence of contamination on the property, the findings of the Phase 1 ESA should provide the required direction for determining which chemical

parameters from soil, groundwater or sediment samples should be selected for analysis in Step 2.

At this time it may be appropriate to think about future public communication needs. Once the outcome of the Phase 1 ESA is known, and a decision to proceed to Step 2 has been made, the details of a plan may be developed. If from the outset, it is known that a detailed site investigation will be needed, then a public communication plan should be developed as part of the Step 1 activity. The proponent should have regard for other public communication needs which may apply, such as those required in a land-use planning process. A carefully developed communication plan may integrate and collectively address different statutory requirements for public consultation.

## Conclusions

At the end of this step, the proponent will have gathered information which should allow a decision to be made on the need to proceed to step two of this process. The information gathered may also allow the proponent to determine whether conditions or events at the site are causing or are likely to cause an adverse effect and require notification to the ministry.

## Documentation

The method, scope of work completed and findings of the Phase 1 ESA should be clearly documented in a report which should be retained by the property owner. One possible report format is provided in Non-Profit Housing Environmental Site Assessment Content and Format Guideline produced by the Ontario Ministry of Housing (1993, revised). Provision of this reference should not imply that all reports must follow this format.

# Site assessment

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## 8.2 Step 2 - Detailed site assessment

The second step in the site assessment process is to confirm and describe contamination at the site. This is known as a Phase 2 environmental site assessment (ESA). When there are buildings on site, there may be a need for an inspection of and a sampling program for the structure. This guideline does not provide information on the sampling of building materials.

Information on collection and analysis of soil, groundwater, sediment and air samples is provided in the accompanying Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario (May 1996a). Laboratory method detection limits (MDL) and information on quality assurance/quality control protocols for sample gathering and laboratory analysis are also provided in that guidance document. Figure 8c outlines some of the elements of a detailed site assessment.

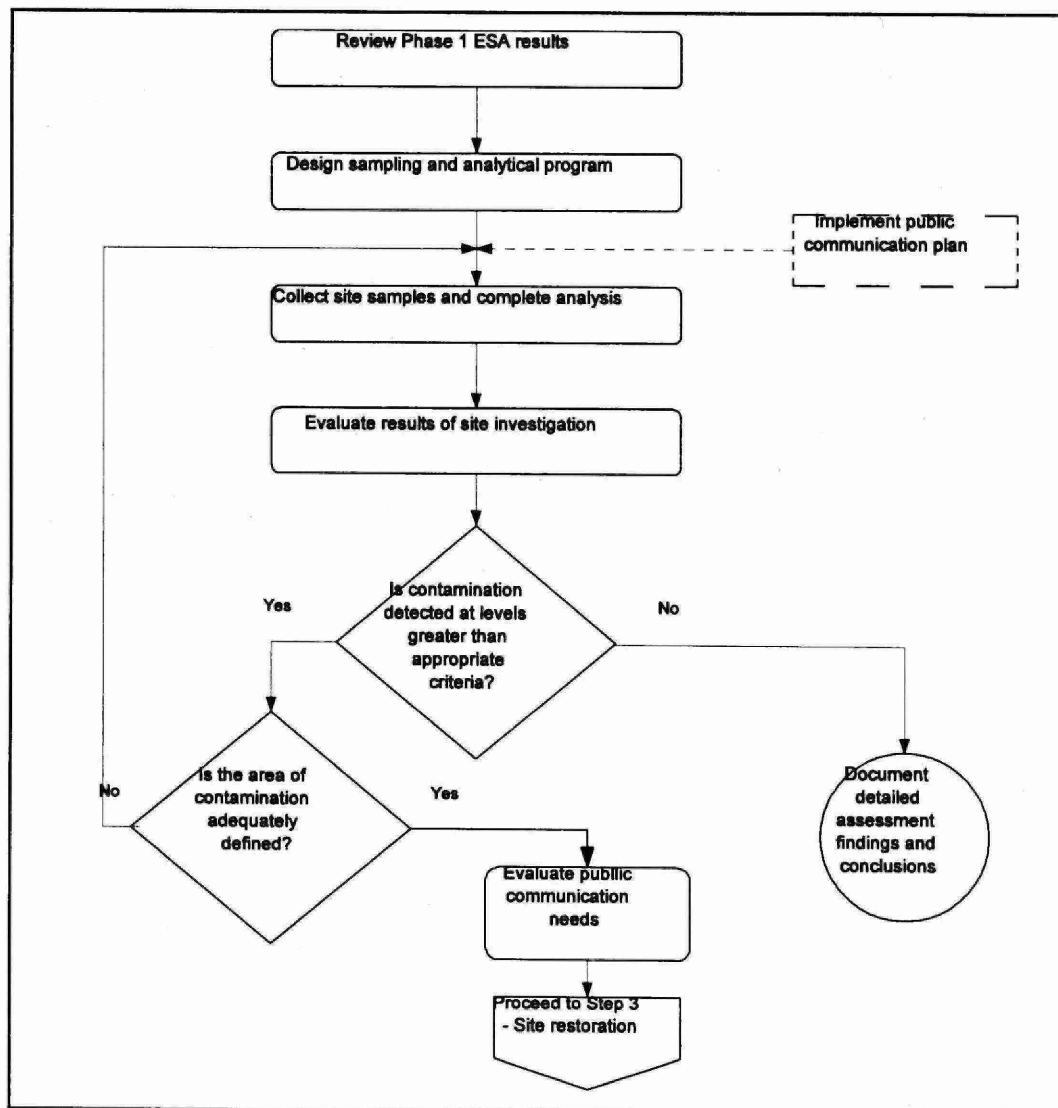
### Phase 2 environmental site assessment (ESA)

A Phase 2 ESA should confirm and identify the type, nature and extent of contamination at a site, or should confirm that the suspected contaminant is not present.

Some of the activities in a Phase 2 ESA include, but are not limited to, the following:

- ▶ surface and subsurface soil sampling, groundwater and surface water sampling, soil vapour sampling (in conjunction with laboratory analysis), sediment sampling, collection of plant or aquatic species samples.
- ▶ above/underground storage tank content and tightness testing, ACM sampling, PCB sampling and identification, geomagnetic or geophysical surveys.
- ▶ testing of building materials for pesticide residues.

Figure 8c: Step 2 – Detailed site assessment



A Phase 2 ESA may include a planning stage, a sample gathering and analysis stage, and a data interpretation and evaluation stage. It is important that information from each stage feed back into the site assessment process to allow program changes as the results of site investigation become available. The chemical parameters initially selected for sample analysis may need to be



# Site assessment

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modified during the Phase 2 ESA, based on the findings during the site assessment.

The type, number, and location of sampling and testing activities are site specific considerations and cannot be generically listed. Sampling or surveys must be undertaken in areas where the Phase 1 ESA has identified the potential for contamination.

There may be an opportunity for, or a benefit to, public communication prior to site investigation and sample collection. This will depend on such things as the size of the site, relationship to the neighbourhood, type of investigation to be undertaken, duration of the investigation, etc., and may be effective in addressing public concerns early in the process. Early public communication may also serve to assist with the consultation required as part of another process, such as the land-use approval process, by providing early information to the community. This form of communication may not be a substitute for the consultation required by statute; however, it can provide a mechanism to assist in achieving the goals of the required consultation.

To assist in determining the presence and extent of contamination, a particularly useful reference containing descriptions of a range of subsurface testing methods is the Subsurface Assessment Handbook for Contaminated Sites (CCME, March 1994) produced by the Waterloo Centre for Groundwater Research, for the Canadian Council of Ministers of the Environment.

## Comparing site data to generic criteria

For generic full depth or stratified, potable or nonpotable groundwater restoration, the site data collected from the Phase 2 ESA should be compared to criteria for soil, sediment, and groundwater in the appropriate table of Appendix 2. This comparison of site data to generic criteria will provide an initial indication of whether there is contamination at the site and the extent of restoration which might be required.

The information provided in Section 6.0 on the use of the generic criteria should also be considered when making these comparisons and when making decisions about the extent of site restoration required.

Table 8a provides a list of conditions under which soil, groundwater, sediment surface water and air samples are considered to have failed in a comparison to the generic criteria. It should not be inferred that testing of all of the listed media is required at all sites.

The criteria and guidance on sediment samples is provided for use in situations where the movement of contaminants from a site has affected sediment quality in adjacent or nearby surface water bodies. Sediment sampling may be required to confirm the extent and nature of the effects of the contaminant movement.

Similarly, the guidance on dealing with the results of surface water sampling is provided for use when a surface water body is suspected of being affected by an adjacent or nearby contaminated site, and sampling of the surface water body is necessary to confirm whether there is contamination.

Air quality monitoring is required at sites where it is anticipated that dust or volatile contaminants may be released during the site restoration process. Monitoring will indicate whether the vapour or dust control measures used at the site are sufficient, so that applicable air quality standards are not surpassed.

# Site assessment

Table 8a: Comparison of analysis to generic criteria

Media	Samples fail the generic criteria if.....
Soil	<p>... the result from a single sample or, if replicate samples are taken, the mean of replicate samples is numerically greater than the criterion for a particular chemical parameter.</p> <ul style="list-style-type: none"> <li>• The soil between the sample site that failed and the next sample site which passes the guideline criterion is considered as having failed the criterion for that chemical parameter.</li> <li>• Additional sampling between these sampling sites will better define the area of contamination.</li> </ul>
Groundwater	<p>... the result from a single sample or, if replicate samples are taken, the mean of replicate samples is numerically greater than the guideline criterion for a particular chemical parameter.</p> <ul style="list-style-type: none"> <li>• This applies only when groundwater quality at the site is of poorer quality than the groundwater quality up gradient of the site for the chemical parameter(s) of concern.</li> </ul>
Surface water	<p>... a comparison of upstream and downstream water quality shows a degradation of water quality not attributable to the cumulative effects of sampling and analytical variation. The difference must be investigated, a cause identified, and a remediation plan developed.</p> <ul style="list-style-type: none"> <li>• This guidance does not apply to situations where the Provincial Water Quality Objectives are being met.</li> </ul>
Sediment	<p>... when sediment quality criteria are provided, the result from any single sample or, if replicate samples are taken, the mean of replicate samples is greater than the lowest effect level. This will require an investigation for the source of the contaminant. If the contaminant source is on site, a remediation plan must be developed.</p> <ul style="list-style-type: none"> <li>• When sediment quality criteria are not provided, and a comparison of upstream and downstream sediment quality shows a degradation in quality not attributable to the cumulative effects of sampling and analytical variation, the cause for the difference must be investigated, identified and a remediation plan developed.</li> </ul>
Air	<p>... if air quality monitoring results are worse than air quality standards, guidelines or applicable criteria. There must be an immediate response to reduce or eliminate the source of the contaminant.</p>

## Conclusions

At the end of this step, the proponent will have gathered site information which will assist in determining the need for a remedial work plan, and in formulating that remedial plan if necessary. The site information gathered may also allow the proponent to determine whether conditions or events at the site are causing or are likely to cause an adverse effect and will require notification to the ministry.

If the findings of the Phase 2 ESA allow the proponent to conclude that the site conditions are appropriate for the intended use and that a remedial work plan is not required, further site investigation is not required (Figures 8a, 8c).

A useful reference which contains information on evaluation of analytical data and analytical methods is Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites. Volume I: Main Report. Volume II: Analytical Method Summaries (CCME 1993).

## Documentation

The types of site investigations undertaken, the results, conclusions and recommendations of the Phase 2 ESA investigations should be clearly documented in a report. Reports produced from the Phase 2 ESA should be provided to and retained by the property owner, and should be passed on to future owners. An example format for a Phase 2 ESA report is provided in the Non-Profit Housing Environmental Site Assessment Review Handbook produced by the Ministry of Housing (1993 revised). The provision of this reference should not imply that all reports must follow this format.

# Site assessment

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## 8.3 Step 3 - Site restoration

The third step in this sequence involves the development and implementation of a plan to remove, treat or otherwise manage the contamination found on the site. There may be components of the plan, such as those which involve treatment or processing of the contaminated material, which require a Certificate of Approval from the ministry. Approval requirements are discussed in this section. A table which provides a summary of some of the types of approval required for some of the activities at contaminated sites is provided in Appendix 1. Figure 8d provides an outline of some of the elements of Step 3.

### The remedial work plan

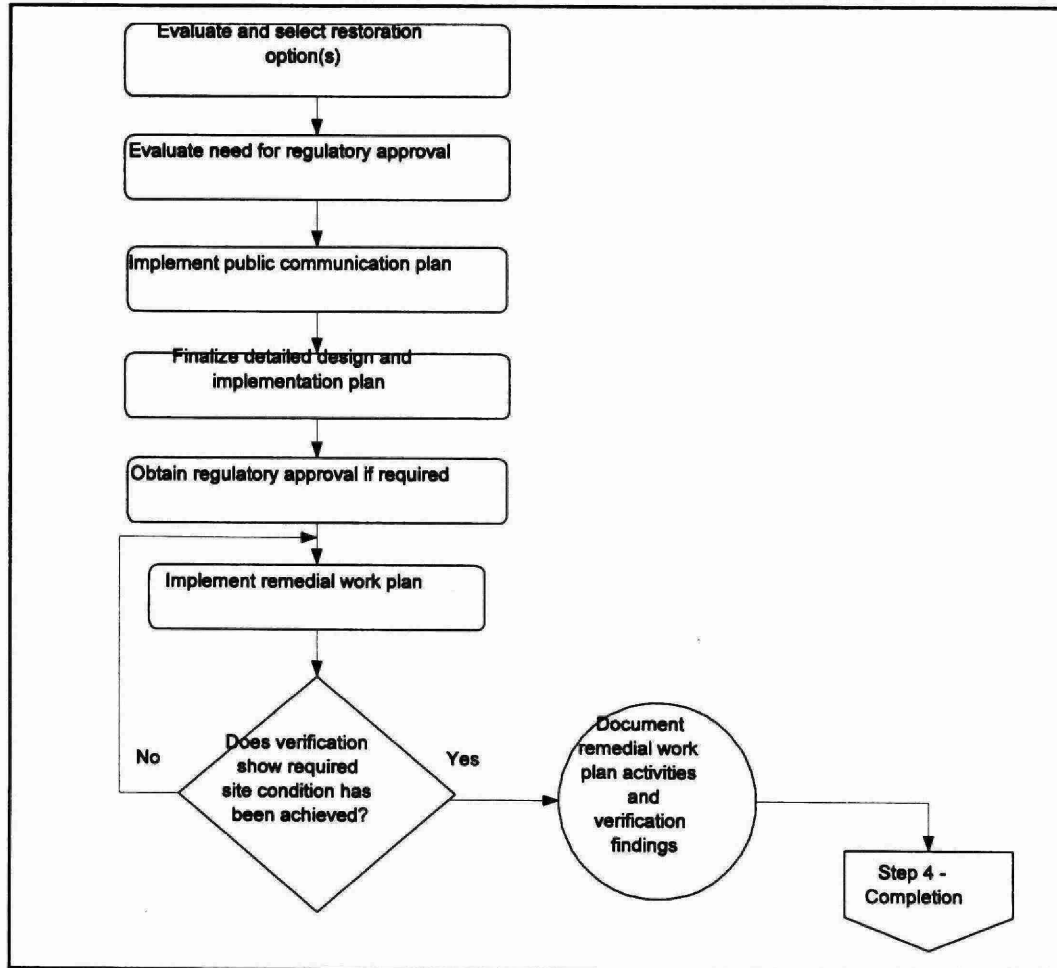
The remedial work plan (RWP) for the contaminated site may include, but is not necessarily limited to:

- ▶ a decision on the site restoration approach to be used;
- ▶ assessment of options for removal, storage, and/or treatment of contaminated material;
- ▶ treatability studies/assessment of technologies;
- ▶ detailed design and implementation;
- ▶ acquiring Certificates of Approval or permits;
- ▶ monitoring and verification sampling.

In developing a remedial plan, the following must be observed:

- ▶ Wastes must be managed in accordance with Part V of the EPA and Reg. 347 (General - Waste Management).

Figure 8d: Step 3 – Remedial work plan



- ▶ If measurable pesticide residues are present in building materials, the reuse of those materials must comply with the requirements of the Pesticides Act (R.S.O. 1990).
- ▶ All reasonable and practicable attempts should be made to remove all solid waste products and phase-separated liquid waste products.

# Site assessment

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- ▶ It is recognized that incidental mixing of soils will occur during some restoration activities. The intentional mixing of on site contaminated soils with clean soils to meet restoration objectives is not recommended or endorsed, except:
  - i. when a beneficial effect to plant growth can be demonstrated (fertility effect for essential macro and micro nutrients). Nutrients which are essential for higher plants include N, P, K, Ca, Mg, Na, S, Fe, B, Cl, Cu, Co, Mn, Mo, and Zn. Proponents considering mixing of soils to satisfy nutrient requirements are advised to discuss use of this option with the ministry (Standards Development Branch);
  - ii. when mixing occurs as part of a remedial activity such as bioremediation or soil washing;
  - iii. in limited cases where site management proposals meet the general requirements for Level 2 risk management as outlined in section 7.2.
- ▶ The ongoing, uncontrolled release of volatile compounds to the air as part of a remedial action is not acceptable. Every effort should be made to recover volatile contaminants and prevent release to the atmosphere.
- ▶ A site which is undergoing restoration may receive soils of a quality consistent with the criteria used for restoration at that site provided it is done in accordance with the remedial work plan for the site. The proponent must ensure that any approvals required for the treatment, transfer or receipt of such soil have been obtained.
- ▶ Soil that has been treated by an approved process may be reused at another site undergoing a restoration provided that this is carried out in accordance with the remedial work plan established for the site receiving this soil, and the approval allows for such use of the soil.

Approval from MOEE is required for activities related to site restoration which involve regulated discharges to the natural environment. Applications for approvals should be made as early as possible in the site assessment process. Proponents are advised to contact the district or regional ministry office, or the Approvals Branch for current information on approval

requirements for use of specific technologies and for guides to the approval application.

The ministry may require that proponents undertake consultation with municipal government and site neighbours prior to issuing an approval. Proponents are advised to discuss the requirements for supporting documentation for approval applications with the district office.

### Verification

The final part of this step involves the verification of the remedial activities undertaken in Step 3. The necessary samples should be collected and analyzed to provide verification that the RWP has dealt with the contamination identified at the site. Where soils have been removed from the site, this may simply involve resampling in the defined area or zone of contamination and ensuring that soil and groundwater conditions are below the selected criteria.

Where Level 2 risk management measures have been used, the installation, operation and effectiveness of the measures or controls must be verified as appropriate. When proponents have completed their verification sampling and analysis, or are using Level 2 risk management measures and have completed the installation of such measures, there are administrative steps which must be completed. These are outlined in Section 8.4.

### Conclusions

At the end of this step, the proponent will have restored the site conditions (soil, groundwater and/ or sediment) so that it is suitable for the intended use. This is done through use of verification sampling, or ensuring that the risk management measures are performing effectively. There may be ongoing monitoring of certain site conditions, and any such monitoring programs should be operational at the end of this step.

### Documentation

The type of restoration undertaken at the site, the results of any verification sampling, or proposed monitoring of risk management measures or site



## Site assessment

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conditions, should be clearly documented in a report. Reports pertaining to the remedial work undertaken should be provided to and retained by the property owner, and should also be provided to future owners. The report format will depend on the nature of the remedial option(s) used at the site. However, they should clearly summarize the activities undertaken, the results obtained, and identify any future actions (monitoring etc.) which may be required.

#### 8.4 Step 4 - Completion

The final step of this sequence is documentation of the entire process followed and establishing a record of the final site conditions. This documentation should outline what the goals of the restoration were, the approach used, the remedial work plan implemented to achieve these goals, and should clearly state whether the restoration was successful in achieving the goals. The documents should be retained by the property owner, so that they may be provided to those interested upon request.

##### Record of site condition

This guideline contains a form called the Record of Site Condition (RSC), which may be completed by the proponent, to serve as a summary of information about the site. Information concerning the type of site condition achieved through restoration, a listing of the available reports and a summary of risk management measures, if any, are recorded on the form. There are statements to be signed by the property owner and the consultant.

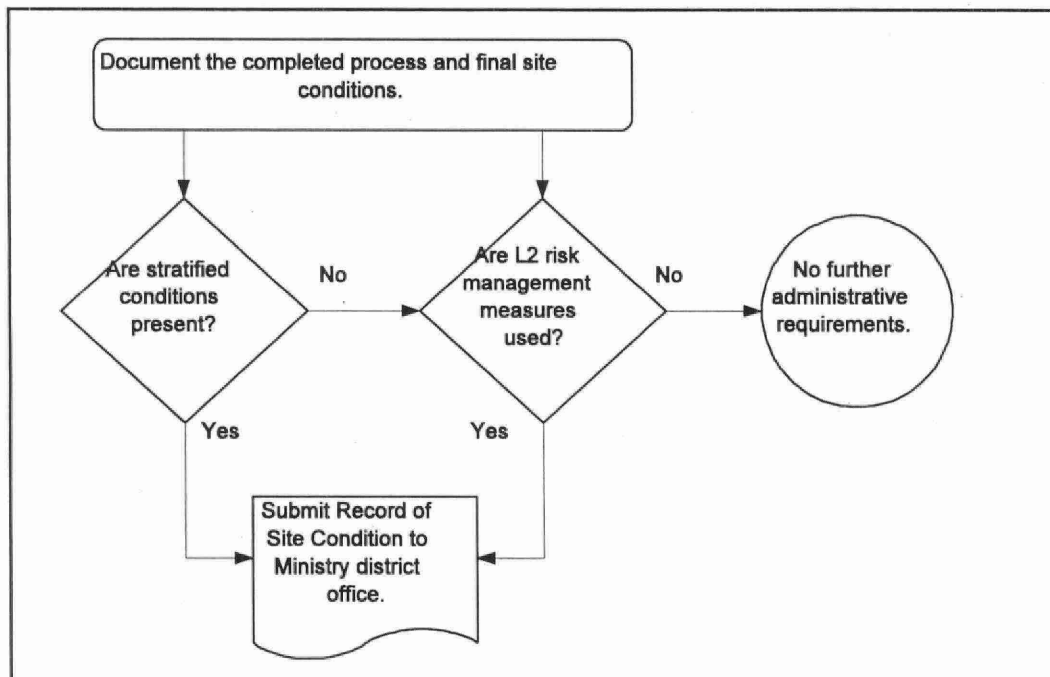
The RSC may be submitted to the ministry for acknowledgement. A Certificate of Status, a certified copy of the most recent deed/transfer for the property and a plan view of the site showing the locations of samples taken for analysis should be attached to the RSC if this acknowledgement is required. Consultant reports should not be included with the RSC.

A copy of the RSC is provided in Appendix 3. When the completed, signed form is submitted to the ministry, different administrative processes are followed for completion. The process used will depend on the type of restoration undertaken at the site and on the final site condition. The administrative elements vary, depending on the level of contamination remaining at the site.

When the proponent concludes, after a Phase 1 or Phase 2 ESA, that further remedial action is not necessary, there are no further administrative requirements. The administrative requirements when full depth or stratified conditions are attained, or when risk assessment/risk management measures are used, are described below.

# Site assessment

Figure 8e: Step 4 – Completion and documentation



The Record of Site Condition should be submitted when:

- ▶ there is a stratified site condition;
- ▶ the risk assessment/risk management (Level 2) approach is used;
- ▶ the proponent wants the ministry to acknowledge receipt of the Record of Site Condition.

When received by the ministry, the Record of Site Condition:

- ▶ makes the ministry aware of sites where restoration has taken place;
- ▶ indicates to the ministry that the proponent has confirmed that the level of restoration is suitable for the intended use of the site.

## Site assessment

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- ▶ establishes that the property owner(s) and consultant(s) have indicated that restoration has been completed in accordance with the information provided in the guideline;
- ▶ provides the ministry with a mechanism to evaluate whether the guideline is providing appropriate and adequate guidance to proponents.

The ministry will review the information provided on the Record of Site Condition, acknowledge receipt of the document, and return a copy to the proponent.

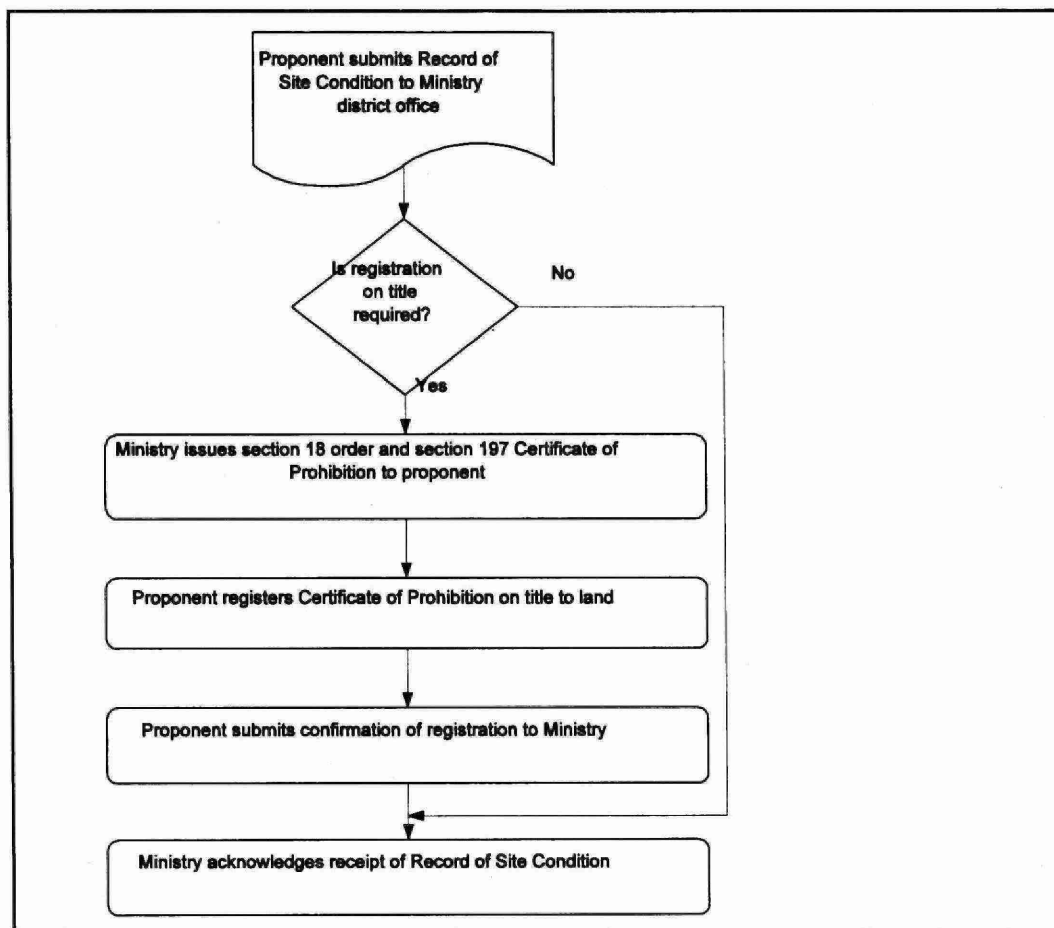
There are two situations when a process different from that outlined above may be followed. These situations are:

- ▶ when a stratified site condition is achieved through remedial work, or where a stratified site condition already exists, without remedial work taking place;
- ▶ when the SSRA approach as outlined in Section 7 is followed and Level 2 risk management measures are used at the site.

The information provided on the Record of Site Condition will be reviewed, and the steps outlined in Figure 8f will be used to complete the registration of a Certificate of Prohibition on title. The ministry will acknowledge receipt of the Record of Site Condition once the process of registration on title is completed.

# Site assessment

Figure 8f: Registration on title to the land



## 8.5 Section 18 order (EPA)

When the stratified approach or site specific risk assessment approach (Level 2 risk management) is used, a Director's Order (EPA, section 18) may be issued to the property owner as outlined in Figure 8f. A draft order, similar to that which may be issued, is set out in Appendix 3.

This order states that a Record of Site Condition has been provided by the proponent which reports that site assessment or restoration has taken place and that the site is suitable for the intended (re)use. The order notes that changes

to the site, such as, for example, the excavation and placement of subsurface soil at the surface, may result in an adverse effect, or the likelihood of an adverse effect, associated with a discharge, as noted in Section 18 of the EPA. The order requires that subsurface soils, when brought to the surface, be further managed to avoid an adverse effect.

### 8.6 Certificate of Prohibition

If a Director's Order is issued to the property owner it may require that the owner register a Certificate of Prohibition against the title to the land, according to section 197 of the EPA. Subsection 197(1) provides that:

*"a person who has authority under the EPA to make an order or decision affecting the real property also has authority to prohibit any person with an interest in the property from dealing with the property in any way without first giving a copy of the order of decision to each person acquiring an interest in the property as a result of the dealing."*

The effect of the order will be to require that any person acquiring an interest in the property be provided with a copy of the order prior to acquiring an interest in the property. A stamped duplicate copy of the registered Certificate of Prohibition must be returned to the ministry confirming that registration has taken place. The ministry will then acknowledge receipt of the Record of Site Condition.

### Certificate of Withdrawal of Prohibition

Subsection 197 (5) (EPA) contains provisions for a Certificate of Withdrawal of Prohibition. If site conditions are further restored so that both surface and subsurface soils meet the full depth or background criteria, the director may decide to issue a Certificate of Withdrawal of Prohibition, which may then be registered on title to the property. This may apply where soil is treated or removed at a later date so that the site then meets full depth generic criteria.

# Site assessment

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## Summary

Tables 8b, 8c, and 8d provide a summary of the roles of the proponent, the ministry and the municipality, and of the administrative requirements associated with the restoration approaches discussed in sections 5, 6 and 7 of this guideline. The guideline text in each of these sections should be referenced for supplementary information on the details provided in these tables.

Table 8b: Roles and responsibilities for different restoration approaches

Consideration	Approach selected by proponent <sup>1</sup>	
	Background approach (soil)	Generic approach Potable option (groundwater)
Role of proponent <sup>2,3</sup> (private or public)	✓ provide Record of Site Condition (RSC) to MOEE only if remedial work was undertaken	✓ provide Record of Site Condition (RSC) to MOEE only if remedial work was undertaken
Role of municipality	✓ land-use permits and planning approvals if required	✓ land-use permits and planning approvals if required
Role of MOEE <sup>2</sup>	✓ provide interpretation of guideline as required	✓ provide interpretation of guideline as required
Administrative measures		
Record keeping <sup>3</sup>	<ul style="list-style-type: none"> <li>✓ proponent provides RSC and retains reports</li> <li>✓ MOEE receives RSC</li> </ul>	<ul style="list-style-type: none"> <li>✓ proponent provides RSC and retains reports</li> <li>✓ MOEE receives RSC</li> </ul>
Registration on title	• not required for background condition	• not required for potable restoration
Reporting to MOEE <sup>2,3</sup>	✓ at Step 4 of guideline process	✓ at Step 4 of guideline process
Technical review		
MOEE review <sup>2</sup>	• not normally required	• not normally required
Peer review	• not required	• not required

<sup>1</sup> Other approaches are listed on Tables 8c and 8d.

<sup>2</sup> MOEE must be notified forthwith if site contamination is causing, or is likely to cause, an adverse environmental effect. Reports may be requested by MOEE.

<sup>3</sup> The Record of Site Condition is not required if site restoration (remedial work) was not undertaken.



# Site assessment

Table 8c: Roles and responsibilities for different restoration approaches

Consideration	Approach selected by proponent <sup>1</sup>	
	Generic approach Full depth option (soil)	Generic approach Stratified option (soil)
Role of proponent <sup>2,3</sup> (private or public)	✓ provide Record of Site Condition (RSC) to MOEE only if remedial work was undertaken	✓ provide RSC to MOEE on completion of process
Role of municipality	✓ land-use permits and planning approvals if required	✓ land-use permits and planning approvals if required
Role of MOEE <sup>2</sup>	✓ provide interpretation of guideline as required	✓ provide interpretation of guideline as required ✓ issue S.18 order and provide Certificate of Prohibition
Administrative measures		
Record keeping <sup>3</sup>	✓ proponent provides RSC and retains reports ✓ MOEE receives RSC	✓ proponent provides RSC and retains reports ✓ MOEE receives RSC
Registration on title	• not required for full depth condition	✓ proponent registers Certificate of Prohibition on title to land ✓ confirmation provided to MOEE
Reporting to MOEE <sup>2,3</sup>	✓ at Step 4 of guideline process	✓ at Step 4 of guideline process
Technical review		
MOEE review <sup>2</sup>	• not normally required	• not normally required
Peer review	• not required	• not required

<sup>1</sup> Other approaches are listed on Tables 8b and 8d.

<sup>2</sup> MOEE must be notified forthwith if site contamination is causing, or is likely to cause, an adverse environmental effect. Reports may be requested by MOEE.

<sup>3</sup> The Record of Site Condition is not required if site restoration (remedial work) was not undertaken.

Table 8d: Roles and responsibilities for different restoration approaches

Consideration	Approach selected by proponent <sup>1</sup>	
	Generic approach Nonpotable option (groundwater)	Risk Assm't/M'gmt approach (soil and/or groundwater)
Role of proponent <sup>2,3</sup> (private or public)	<ul style="list-style-type: none"> <li>✓ notify municipality of intention to use nonpotable approach</li> <li>✓ provide Record of Site Condition (RSC) to MOEE</li> </ul>	<ul style="list-style-type: none"> <li>✓ consults with municipality on use of SSRA approach</li> <li>✓ documentation of peer review</li> <li>✓ provides documentation for MOEE review after peer review</li> </ul>
Role of municipality	<ul style="list-style-type: none"> <li>✓ land-use permits and planning approvals if required</li> </ul>	<ul style="list-style-type: none"> <li>✓ may enter into an agreement with proponent, depending on specifics of level 2 RM</li> </ul>
Role of MOEE <sup>2</sup>	<ul style="list-style-type: none"> <li>✓ provide interpretation of guideline as required</li> </ul>	<ul style="list-style-type: none"> <li>✓ preconsultation advice as required</li> <li>✓ review and comment following peer review</li> <li>✓ issue S. 18 Order and Certificate of Prohibition</li> </ul>
Administrative measures		
Record keeping <sup>3</sup>	<ul style="list-style-type: none"> <li>✓ proponent provides RSC and retains reports</li> <li>✓ MOEE receives RSC</li> </ul>	<ul style="list-style-type: none"> <li>✓ proponent provides RSC to MOEE and retains reports</li> <li>✓ MOEE receives RSC and any reports provided</li> </ul>
Registration on title	<ul style="list-style-type: none"> <li>• not required for nonpotable condition</li> </ul>	<ul style="list-style-type: none"> <li>✓ proponent registers Cert. of Prohibition against land title</li> <li>✓ confirmation provided to MOEE</li> </ul>
Reporting to MOEE <sup>2,3</sup>	<ul style="list-style-type: none"> <li>✓ at Step 4 of guideline process</li> </ul>	<ul style="list-style-type: none"> <li>✓ after peer review and resolution of issues raised</li> <li>✓ on completion of process</li> </ul>
Technical review		
MOEE review <sup>2</sup>	<ul style="list-style-type: none"> <li>• not normally required</li> </ul>	<ul style="list-style-type: none"> <li>• after peer review</li> </ul>
Peer review	<ul style="list-style-type: none"> <li>• not required</li> </ul>	<ul style="list-style-type: none"> <li>• required before MOEE review</li> </ul>

<sup>1</sup> Other approaches are listed on Tables 8b and 8c.

<sup>2</sup> MOEE must be notified if site contamination is causing, or is likely to cause, an adverse environmental effect. Reports may be requested by MOEE.

<sup>3</sup> The Record of Site Condition is not required if site restoration was not undertaken.

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## 9.0 Approving the land use or change of land use

The Minister of Municipal Affairs and Housing, or the appropriate approval authority has a responsibility under to the Planning Act (R.S.O. 1990) to have regard for matters of provincial interest, including public health and safety and the protection of the natural environment, when making decisions on land- use planning matters. This guideline does not, in any way, modify or affect those statutory responsibilities. Local municipalities also have an interest in protecting public health and safety and the natural environment when making decisions regarding land-use planning matters.

A planning application which proposes the reuse or redevelopment of a contaminated or potentially contaminated site may require approval through a number of different planning mechanisms under to the Planning Act such as: an official plan amendment; zoning bylaw amendment; plan of subdivision; site plan agreement or minor variance. During the process of granting planning approvals, the need to restore a contaminated site to a level suitable for the proposed use should be recognized by the approval authority, the municipality and the proponent.

## 9.1 Municipal mechanisms for land-use control

There are various mechanisms under the Planning Act which may be used to both identify contaminated and potentially contaminated sites and to guide/control the use of such lands. These mechanisms include the official plan, secondary plans, amendments to the official plan, community improvement areas, zoning bylaws and amendments, zoning bylaw holding provisions, interim control bylaws, density bonusing, subdivision control, site plan control, and conditions to minor variance and consent approval.

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The official plan is the principal mechanism available to a municipality when considering the reuse of potentially contaminated sites. The Planning Act defines an official plan as:

*a document approved by the Minister of Municipal Affairs and Housing, containing objectives and policies established primarily to provide guidance for the physical development of a municipality or a part thereof or an area that is without municipal organization, while having regard to relevant social, economic and environmental matters.*

All decisions made by a municipal council regarding land-use planning applications must conform to the municipality's official plan. Consequently, a municipality's policy objectives for efficient reuse of contaminated sites, while ensuring the safety of present and future residents, can be specified in the official plan.

Municipalities are encouraged to develop and adopt official plans which identify known or suspected areas of soil or groundwater contamination on the land-use schedule or other official plan map, and to develop policies that outline the conditions which must be satisfied before development may proceed in areas where soil contamination is known or suspected. The document Historical Land Use: A Guide for Ontario Municipalities (in press) may be a useful reference for municipalities wishing to identify such suspected areas of contamination. This document has been produced by the Canadian Urban Institute and the Environmental Protection Office of the Department of Public Health, City of Toronto.

In general, a municipal official plan may include policies to identify general conditions which would indicate the potential for soil contamination to have occurred, to require information to be compiled by a landowner prior to approval of development on lands where contamination may have occurred, and to require verification that a site has been restored and made suitable for the use proposed.

If appropriate provisions are set out in the municipality's official plan, the municipality may more effectively apply other land-use control mechanisms available under the Planning Act. Table 9.1 identifies various mechanisms for

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land-use planning and the opportunities and limitations when considering the redevelopment of contaminated sites.

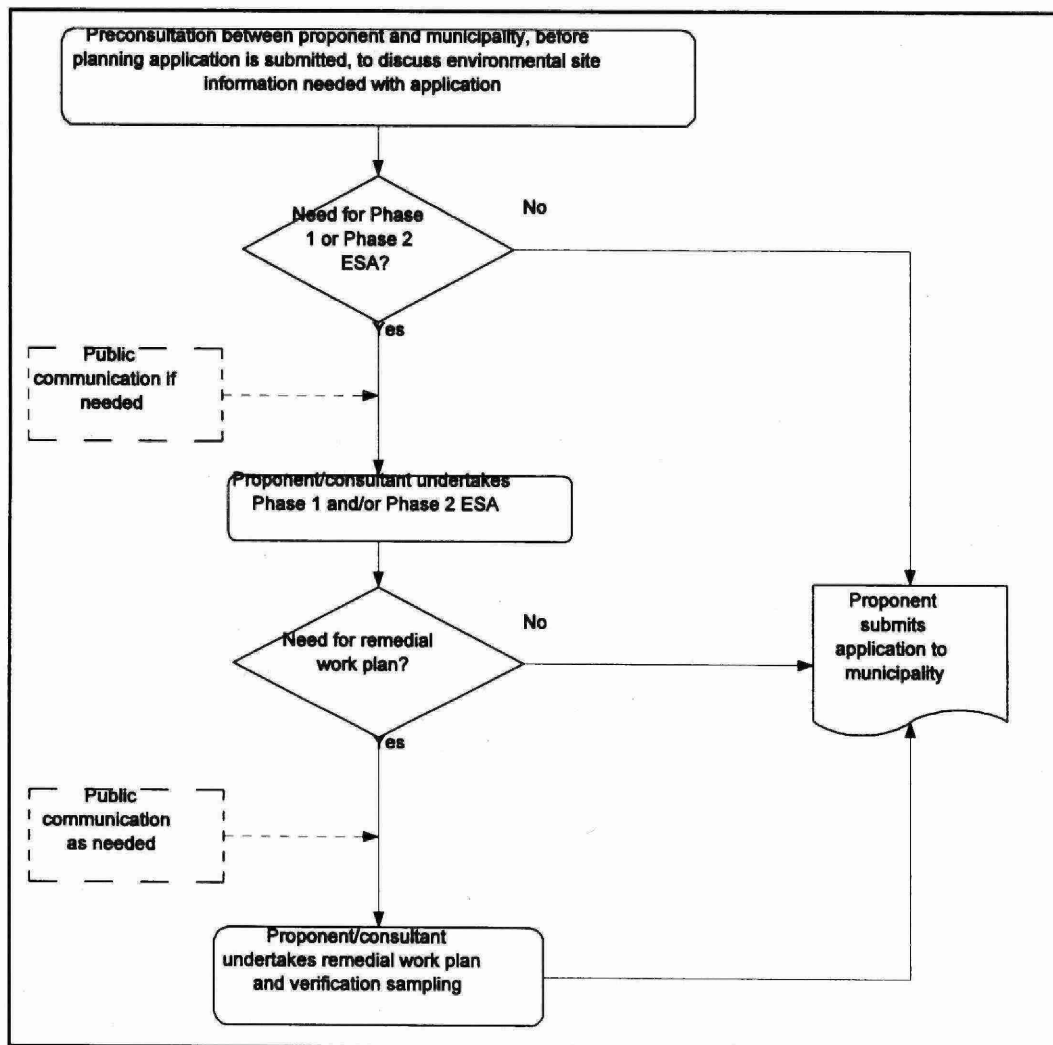
## 9.2 Site assessment and land-use approvals

When site reuse or redevelopment is proposed, the land-use approval authority may request that the proponent confirm that the environmental condition of the site is suitable for the proposed use. A site which is contaminated, or may be potentially contaminated, should be assessed and, if necessary, conditions and/or agreements outlining the requirements for restoration should be in place before approval for the reuse or redevelopment of the site is granted.

Municipalities may consider whether completion of a Phase 1 ESA is to be requested prior to the planning application being received by the local municipality. A municipality's official plan may identify this as a general requirement for those sites which are potentially contaminated. If further investigation is not required after an initial site assessment is completed the planning application and supporting documentation on site conditions may then be submitted to the local municipality for consideration. A report with the findings and conclusions of the Phase 1 ESA should be submitted with the planning application. The official plan may contain a policy that a report on the initial site assessment (section 8.1) must be provided by the proponent, or the consultant for the proponent.

If the Phase 1 ESA indicates that a Phase 2 ESA is necessary, the municipality may request that the proponent complete the Phase 2 ESA prior to the planning application being received by the local municipality. If the results of the Phase 2 ESA indicate that a remedial work plan is not required, the planning application and supporting documentation regarding site conditions (i.e. the Phase 2 ESA report) may then be submitted to the local municipality for consideration. The official plan may provide a policy that a report on the detailed site assessment (section 8.2) must be provided by the proponent or the consultant for the proponent. One way of integrating the site assessment and restoration process and the land-use planning process is shown in Figure 9a. The process outlined in Figure 9a is not meant to be the only method of integrating these processes, nor the prescribed method. However, it does reflect the discussion provided in this section.

Figure 9a: Integrating site assessment with land-use planning



The ministry recommends that the guideline criteria be used as triggers for further investigation when the criteria are exceeded, and as the restoration level for the future land-use where a change in land use is to be made.

The property owner should maintain a copy of the Phase 1 and/or Phase 2 report(s). The report(s) may be provided to those who may have an interest in

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the property in future, and who wish to understand the environmental condition of the property.

## 9.3 Remedial work plans and land-use approvals

When the results of the Phase 2 ESA indicate that a remedial work plan and site restoration is required, municipalities may consider whether the design of the remedial work plan (section 8.3) should be completed prior to a final favorable decision on a planning application. The official plan may provide a policy that a report on the design of the remedial work plan must be submitted by the proponent or the consultant for the proponent prior to a final decision being provided.

It is recommended that the proponent communicate with the municipality when selecting the restoration approach, or combination of approaches, before finishing the detailed design of the remedial work plan. Specifically, the proponent should notify the municipality when the nonpotable groundwater restoration approach or risk management (Level 2) is to be used. In keeping with the current planning approval process, the municipality will have to select and make use of the appropriate planning mechanism to ensure that site remediation as proposed by the proponent is implemented and completed in conjunction with its planning approval process.

The planning mechanism selected for use will depend on the type of planning application being made. The official plan should contain clear policies that stipulate approval of development proposals shall be conditional on appropriate measures to ensure proposed remedial works are carried out. These may include conditions for subdivision and consent approvals, development control agreements and the use of zoning bylaw holding provisions. It is recommended that the municipality make final approval of planning applications conditional on the verification of final site conditions.

There may be a need for ongoing land use restrictions, for example, where nonpotable groundwater criteria has been used for site restoration. There may be a need to restrict the type of land use or the potential for future site alteration when a stratified site condition exists, or when risk management (Level 2) has been used. Land-use restrictions may be established through

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official plan designations, official plan policy statements and/or zoning. Such designations and/or zoning categories should clearly identify the nature of the restriction associated with the land use.

The proponent or municipality may consult with the ministry at any time during the Phase 1 or Phase 2 assessment, or prior to development of the remedial work plan, for clarification, or further interpretation of the information provided in this guideline. The ministry may also be consulted on specific technical matters of interest to the municipality, where assistance is needed in the municipal decision-making process.

Information provided by the proponent, or consultant, in support of the planning application should be used by the municipality in coming to a decision on the granting of the land-use approval. The proponent and consultant to the proponent remain responsible for ensuring that accurate information is provided to the land-use approval authority and that the restored or existing site condition is suitable for the intended site use.

### 9.4 Agreements between municipalities and proponents

When the SSRA approach (risk management, level 2) is being considered for use at a site, there is the potential for long term risk management measures to remain in place and/or be monitored and maintained for a long or indefinite period of time. The responsibility for operating, maintaining and monitoring such risk management measures may be set out in an agreement between the proponent and municipality. The ministry will not be party to such agreements.

When a municipality does enter into such an agreement, the remedial measures used and subsequent condition and use of the site will influence the specific type of land-use control which may be needed, and the nature of the agreement which the municipality and proponent may enter into. Table 9.1, at the end of this section, provides examples of land-use planning mechanisms which may be used to secure land-use controls and agreements.

The municipality may wish to consider obtaining indemnification and financial assurance from the property owner, of a nature suitable to address any



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problems which may arise in future, as part of the agreement with the proponent. In the event that the risk management measure fails to function, and this failure results in an adverse effect, or the likelihood of an adverse effect, notification must be provided to the ministry.

## 9.5 Public consultation in land-use planning

Most municipal land-use planning processes require one or more public meetings before a final decision is rendered. The Planning Act (R.S.O. 1990) provides minimal legislative public consultation requirements for official plans, plans of subdivision, consents, zoning bylaws and minor variances. Where site restoration is required and the planning process provides opportunities for public consultation, it is recommended that notification of and/or consultation on the findings of the initial site assessment, detailed site assessment or remedial work plan be included within these other formal consultation processes as appropriate. Sections 3 and 8 of this guideline provide additional information on public communication and the site assessment process respectively.

## 9.6 Role of ministry in the SSRA process

The ministry will undertake a technical review of the risk assessment and risk management documentation prepared by the proponent in support of an application for a land-use change, when it is provided by the municipality. Section 7 of this guideline provides an outline of the type of information which should be in the risk assessment and risk management documents. Additional information on the use of risk assessment is contained in Guidance on Site Specific Risk Assessment for Use at Contaminated Sites in Ontario (May 1996b).

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Table 9a: Land use planning mechanisms

Planning mechanism	Opportunities	Considerations
Official plan	Allows the municipality to outline objectives and policies with respect to identification, assessment, and restoration requirements for potentially contaminated lands, on a municipality-wide basis.	Policies need to balance the flexibility of official plan policy while providing sufficient direction on how and when site contamination will be addressed through the municipal development approval process.
Secondary plan (official plan amendment)	<p>Allows the municipality to outline objectives and policies as with an official plan, but applies to a specifically identified portion of the municipality.</p> <p>Development of a secondary plan usually follows or requires detailed studies of the subject area, and consequently, policies and objectives contained within a secondary plan may be tailored to apply to known, or potentially contaminated sites within the relevant area.</p>	Detailed policies and objectives only apply to the area included within the secondary plan area.
Site specific official plan amendment	<p>Allows the municipality to clearly enunciate objectives for development of a specific site, including details regarding identification, assessment, restoration and verification sampling requirements.</p> <p>Development of site specific policy can follow submission of detailed site information by development proponent.</p>	Requires inclusion of site specific policy and objectives that tend to be considered exceptions to the otherwise general rules of the official plan.
Zoning bylaws and amendments	<p>Allows the municipality to prohibit the use of land for, or except for, that set out in the bylaw.</p> <p>Prior to the enactment of a zoning bylaw permitting a specific type of use, a municipality may require a development proponent to undertake studies to demonstrate that the subject lands are suitable for the use proposed.</p>	<p>Used later in the land-use planning process. Considerable investment by a proponent may have already been made by the time zoning amendment application is made, thereby limiting the use of this land-use control mechanism.</p> <p>Amendment to the zoning bylaw may not be necessary where the zoning in place already permits the proposed use.</p>

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Planning mechanism	Opportunities	Considerations
Holding provisions, zoning bylaws	May be used to grant approval of a proposed zoning amendment conditional upon municipal satisfaction that certain matters as set out in the bylaw have been addressed (e. g. detailed assessment of on-site soil quality, preparation of an acceptable remedial work plan, verification plan).	Used later in the land-use planning process. Official plan must contain provisions relating to the use of holding bylaws.
Density bonusing	May be used to offer proponent development rights greater than what is otherwise permitted in return for completion of site assessment and restoration.  Provides for the use of an agreement between municipality and developer to require completion of the site assessment and restoration by the developer.	Used later in land-use planning process. Official plan must contain provisions relating to the use of density bonusing.
Site plan approval	Allows municipality to set out conditions of approval and agreements between municipality and developer which require the developer to provide certain facilities, works, or other matters.	Is generally regarded to apply to matters relating to safety/convenience of the development as determined by physical characteristics of site layout. May be useful when used in conjunction with other mechanism e.g. bylaws. Official plan must contain provisions relating to the use of site plan control.
Subdivision, condominium	Provides for the use of agreements between the municipality and proponent to require that site restoration and monitoring/maintenance is carried out.	Existing built-up industrial areas are not frequently developed by plan of subdivision.
Minor variance	Allows municipality to apply conditions to the approval of minor variances to the zoning bylaw. Minor variances must comply with the general intent of the official plan.	Generally, only applied to authorize minor variance (extensions, enlargements, similar use) from performance standards of the zoning bylaw.

## Acknowledgements

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The members of the steering committee at the time of finalization of this document are listed below. Committee membership has changed over time and the members acknowledge the work and contributions of those who participated in the past.

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On behalf of the members of the Steering Committee,

*Ronald A. Lall*

Committee Chairperson  
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## APPENDIX 1

### Summary of approvals information

Table A1: Summary of approvals information

SITE ACTIVITY	ENVIRONMENTAL PROTECTION ACT						ONTARIO WATER RESOURCES ACT	ENVIRONMENTAL ASSESSMENT ACT <sup>3</sup>
	SECTION 9 APPROVAL FOR AIR EMISSIONS <sup>1</sup>	PART V		PART VIII	WASTE GENERATOR REGISTRATION	PCB O.Reg 362 <sup>2</sup>		
		WASTE SITE	WASTE SYSTEM <sup>11</sup>					
Excav./ processing of on-site contaminated soil/demolition <sup>10</sup>	Possible	Possible	No	No	Possible	Possible	Possible	No
Disposal of contaminated soil to approved off-site facility	No	No	Yes	No	Possible	Possible	No	No
Establishing landfill facility for disposal of contaminated soil • haz waste/liquid • non-haz solid ≥40,000 cu m 								

footnotes are on the following page

**Footnotes for Table A1**

- 1 Section 9 air approval required for any activity discharging airborne contaminants to the natural environment.
- 2 O.Reg 362 Approval required for management of PCB wastes.
- 3 EAA applies to all provincial waste facilities unless specifically exempt; municipal waste facilities or activities as required by the municipal regulation made under the EAA (any site with a mandatory hearing under Part V is also subject to the EAA); private sector waste proposals designated by the Minister; any proposal designated by the Minister.
- 4 Mandatory hearing if waste to be landfilled is equivalent to the waste of 1,500 persons or more; discretionary hearing if waste is less than 1,500 person equivalent.
- 5 EPA hearings under S. 32
- 6 EPA hearings under S. 32 not required.
- 7 EAA approval will lead to EPA Part V approval.
- 8 Permit to Take Water is required if pumping greater than 50,000 litres/day. Discharge point will dictate if ODWO, PWQO or sewer use bylaw are to be met.
- 9 This refers to 200 tonnes per day (TPD) of waste residual, not TPD of material processed
- 10 Includes land farming facilities.
- 11 Applies only to the system (hauler) used to move the waste, not to the treatment system if nonmobile.

## APPENDIX 2

### Summary of soil, groundwater and sediment criteria

Table A: Surface soil and groundwater criteria for a potable ground water condition (A9)

Table B: Surface soil and groundwater criteria for a nonpotable ground water condition (A15)

Table C: Subsurface soil criteria for a potable groundwater condition (A21)

Table D: Subsurface soil criteria for a nonpotable ground water condition (A27)

Table E: Sediment quality criteria (A33)

Table F: Ontario Typical Range soil concentrations (background) (A39)

**Table A**

**Surface soil and groundwater criteria for agricultural,  
residential/parkland, industrial/commercial land use for a  
potable groundwater condition**

Table A: Surface soil and groundwater remediation criteria for three land uses (agricultural, residential/parkland and industrial/commercial) in a potable groundwater situation.

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 9.0.				
Table A:	Soil remediation criteria (ug/g)			Potable groundwater criteria (ug/l)
Chemical compound	Agricultural land use	Residential/ parkland land use	Industrial/ commercial land use	All land use categories
ACENAPHTHENE	15	15	15	20
ACENAPHTHYLENE	100	100	130	310
ACETONE	3.5	3.5	3.5	3000
ALDRIN	0.05	0.05	0.05	0.01
ANTHRACENE	28	28	28	12
ANTIMONY	13	13	(44) 40	6.0
ARSENIC	(25) 20	(25) 20	(50) 40	25
BARIUM	(1000) 750	(1000) 750	(2000) 1500	1000
BENZENE	0.24	0.24	0.24	5.0
BENZO(a)ANTHRACENE	6.6	6.6	6.6	0.2
BENZO(a)PYRENE	1.2	1.2	1.9	0.01
BENZO(b)FLUORANTHENE	12	12	18	0.2
BENZO(g,h,i)PERYLENE	40	40	40	0.2
BENZO(k)FLUORANTHENE	12	12	18	0.2
BERYLLIUM	1.2	1.2	1.2	4.0
BIPHENYL, 1,1-	0.89	0.89	0.89	350
BIS(2-CHLOROETHYL)ETHER	0.66	0.66	0.66	4.4
BIS(2-CHLOROISOPROPYL)ETHER	0.66	0.66	0.66	2.2
BIS(2-ETHYLHEXYL)PHTHALATE	100	100	100	6.0
BORON (AVAILABLE)	1.5*	1.5*	2.0*	5000
BROMODICHLOROMETHANE	0.12	0.12	0.12	5.0
BROMOFORM	0.11	0.11	0.11	5.0
BROMOMETHANE	(0.37) 0.061	(0.37) 0.061	(0.37) 0.061	(10) 3.7
CADMIUM	(4.0) 3.0	12	12	5.0
CARBON TETRACHLORIDE	(0.41) 0.10	(0.41) 0.10	(0.41) 0.10	5.0
CHLORDANE	0.29	0.29	0.29	0.04

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 9.0.

Table A:	Soil remediation criteria (ug/g)			Potable groundwater criteria (ug/l)
Chemical compound	Agricultural land use	Residential/ parkland land use	Industrial/ commercial land use	All land use categories
CHLOROANILINE, p-	1.3	1.3	1.3	28
CHLOROBENZENE	2.4	2.4	2.4	30
CHLOROFORM	0.13	0.13	0.13	5.0
CHLOROPHENOL, 2-	0.1	0.1	0.1	0.3
CHROMIUM (TOTAL)	(1000) 750	(1000) 750	(1000) 750	50
CHROMIUM (VI)	(10) 8.0	(10) 8.0	(10) 8.0	50
CHRYSENE	12	12	17	0.5
COBALT	(50) 40	(50) 40	(100) 80	100
COPPER	(200) 150	(300) 225	(300) 225	23
CYANIDE (FREE)	100	100	100	52
DIBENZO(a,h)ANTHRACENE	1.2	1.2	1.9	0.2
DIBROMOCHLOROMETHANE	0.09	0.09	0.09	5.0
DICHLOROBENZENE, 1,2- (o-DCB)	0.88	0.88	0.88	3.0
DICHLOROBENZENE, 1,3- (m-DCB)	30	30	30	630
DICHLOROBENZENE, 1,4- (p-DCB)	0.32	0.32	0.32	1.0
DICHLOROBENZIDINE, 3,3'-	1.3	1.3	1.3	83
DDD	2.2	2.2	3.5	6.0
DDE	1.6	1.6	2.4	20
DDT	1.6	1.6	2.0	0.05
DICHLOROETHANE, 1,1-	3.0	3.0	3.0	70
DICHLOROETHANE, 1,2-	(0.034) 0.022	(0.034) 0.022	(0.034) 0.022	5.0
DICHLOROETHYLENE, 1,1-	(0.0085) 0.0024	(0.0085) 0.0024	(0.0085) 0.0024	(4.1) 0.66
DICHLOROETHYLENE, CIS-1,2-	2.3	2.3	2.3	70
DICHLOROETHYLENE, TRANS-1,2-	4.1	4.1	4.1	100
DICHLOROPHENOL, 2,4-	0.3	0.3	0.3	0.3
DICHLOROPROPANE, 1,2-	(0.035) 0.019	(0.035) 0.019	(0.035) 0.019	5.0
DICHLOROPROPENE, 1,3-	(0.015) 0.0066	(0.015) 0.0066	(0.015) 0.0066	1.4
DIELDRIN	0.05	0.05	0.05	0.02

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 9.0.				
Table A:	Soil remediation criteria (ug/g)			Potable groundwater criteria (ug/l)
Chemical compound	Agricultural land use	Residential/ parkland land use	Industrial/ commercial land use	All land use categories
DIETHYL PHTHALATE	0.71	0.71	0.71	30
DIMETHYL PHTHALATE	0.7	0.7	0.7	30
DIMETHYLPHENOL, 2,4-	0.94	0.94	0.94	140
DINITROPHENOL, 2,4-	0.2	0.2	0.2	42
DINITROTOLUENE, 2,4-	0.66	0.66	0.66	0.5
DIOXIN/FURAN (ng TEQ/g soil)	0.01	1.0	1.0	0.000015
ENDOSULFAN	0.18	0.18	0.18	0.35
ENDRIN	0.05	0.05	0.05	0.05
ETHYLBENZENE	0.28	0.28	0.28	2.4
ETHYLENE DIBROMIDE	(0.007) 0.0056	(0.007) 0.0056	(0.007) 0.0056	1.0
FLUORANTHENE	40	40	40	130
FLUORENE	340	340	340	280
HEPTACHLOR	0.084	0.084	0.084	0.04
HEPTACHLOR EPOXIDE	0.06	0.06	0.09	3.0
HEXACHLOROBENZENE	0.46	0.46	0.76	(1.0) 0.62
HEXACHLOROBUTADIENE	(0.4) 0.38	(0.4) 0.38	(0.4) 0.38	0.45
HEXACHLOROCYCLOHEXANE, Gamma	0.41	0.41	0.49	0.8
HEXACHLOROETHANE	(3.9) 3.8	(3.9) 3.8	(3.9) 3.8	2.5
INDENO(1,2,3-cd)PYRENE	12	12	19	0.2
LEAD	200	200	1000	10
MERCURY	10	10	10	0.12
METHOXYCHLOR	4.0	4.0	4.0	0.3
METHYL ETHYL KETONE	0.27	0.27	0.27	350
METHYL ISOBUTYL KETONE	0.48	0.48	0.48	350
METHYL MERCURY	6.8**	6.8**	10**	0.12
METHYL TERT BUTYL ETHER	5.7	5.7	5.7	700
METHYLENE CHLORIDE	1.1	1.1	1.1	50
METHYLNAPHTHALENE, 2-(*1-)	1.2	1.2	1.2	10



Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 9.0.

Table A:	Soil remediation criteria (ug/g)			Potable groundwater criteria (ug/l)
Chemical compound	Agricultural land use	Residential/ parkland land use	Industrial/ commercial land use	All land use categories
MOLYBDENUM	5.0	40	40	7300
NAPHTHALENE	4.6	4.6	4.6	21
NICKEL	(200) 150	(200) 150	(200) 150	100
PENTACHLOROPHENOL	5.0	5.0	5.0	30
PETROLEUM HYDROCARBONS (gas/diesel)	100	100	100	1000
PETROLEUM HYDROCARBONS (heavy oils)	1000	1000	1000	1000
PHENANTHRENE	40	40	40	63
PHENOL	40	40	40	4200
POLYCHLORINATED BIPHENYLS	0.5	5.0	25	0.2
PYRENE	1.3	1.3	1.3	0.2
SELENIUM	2.0	10	10	10
SILVER	(25) 20	(25) 20	(50) 40	1.2
STYRENE	(1.7) 1.2	(1.7) 1.2	(1.7) 1.2	100
TETRACHLOROETHANE, 1,1,1,2-	(0.06) 0.019	(0.06) 0.019	(0.06) 0.019	5.0
TETRACHLOROETHANE, 1,1,2,2-	0.01	0.01	0.01	1.0
TETRACHLOROETHYLENE	0.45	0.45	0.45	5.0
THALLIUM	4.1	4.1	32	2.0
TOLUENE	2.1	2.1	2.1	24
TRICHLOROBENZENE, 1,2,4-	30	30	30	70
TRICHLOROETHANE, 1,1,1-	(34) 26	(34) 26	(34) 26	200
TRICHLOROETHANE, 1,1,2-	0.28	0.28	0.28	5.0
TRICHLOROETHYLENE	(2.6) 1.1	(2.6) 1.1	(2.6) 1.1	50
TRICHLOROPHENOL, 2,4,5-	3.2	3.2	3.2	200
TRICHLOROPHENOL 2,4,6-	0.66	0.66	0.66	2.0
VANADIUM	(250) 200	(250) 200	(250) 200	200
VINYL CHLORIDE	(0.0048) 0.003	(0.0048) 0.003	(0.0048) 0.003	(1.3) 0.5
XYLENES	25	25	25	300

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 9.0.				
Table A:	Soil remediation criteria (ug/g)			Potable groundwater criteria (ug/l)
Chemical compound	Agricultural land use	Residential/ parkland land use	Industrial/ commercial land use	All land use categories
ZINC	(800) 600	(800) 600	(800) 600	1100
ELECTRICAL CONDUCTIVITY (mS/cm)	0.70	0.70	1.4	N/A
CHLORIDE	N/V	N/V	N/V	250000
NITRATE	N/V	N/V	N/V	10000
NITRITE	N/V	N/V	N/V	1000
SODIUM ADSORPTION RATIO (SAR)	5.0	5.0	12	N/A
SODIUM	N/V	N/V	N/V	200000

( ) Criterion value in brackets applies to medium and fine textured soils.

+ Boron soil criterion based on Hot Water Extract.

N/A = Not applicable. N/V = No Value.

++ Analysis for methyl mercury is only required when the total mercury criterion is exceeded.

(\*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

**Table B**

**Surface soil and groundwater criteria for residential/parkland,  
industrial/commercial land use for a nonpotable groundwater  
condition**

Table B: Surface soil and groundwater remediation criteria for two land uses (residential/parkland and industrial/commercial) in a nonpotable groundwater situation.

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 9.0			
Table B:	Soil remediation criteria (ug/g)		Nonpotable groundwater criteria (ug/l)
Chemical compound	Residential/ parkland land use	Industrial/ commercial land use	Both land use categories
ACENAPHTHENE	1000	1300	1700
ACENAPHTHYLENE	100	840	2000
ACETONE	3.8	3.8	3300
ALDRIN	0.05	0.05	(1.3) 0.2
ANTHRACENE	28	28	12
ANTIMONY	13	(44) 40	16000
ARSENIC	(25) 20	(50) 40	480
BARIUM	(1000) 750	(2000) 1500	23000
BENZENE	(12) 5.3	(12) 5.3	(12000) 1900
BENZO(a)ANTHRACENE	40	40	5.0
BENZO(a)PYRENE	1.2	1.9	1.9
BENZO(b)FLUORANTHENE	12	19	7.0
BENZO(g,h,i)PERYLENE	40	40	0.2
BENZO(k)FLUORANTHENE	12	19	0.4
BERYLLIUM	1.2	1.2	53
BIPHENYL, 1,1-	4.3	4.3	1700
BIS(2-CHLOROETHYL)ETHER	0.66	0.66	(710) 110
BIS(2-CHLOROISOPROPYL)ETHER	(0.85) 0.82	(0.85) 0.82	(2700) 430
BIS(2-ETHYLHEXYL)PHTHALATE	130	330	30
BORON (AVAILABLE)	1.5*	2.0*	50000
BROMODICHLOROMETHANE	14	25	50000
BROMOFORM	(2.6) 2.3	(2.6) 2.3	(5200) 840
BROMOMETHANE	(0.37) 0.061	(0.37) 0.061	(16) 3.7
CADMIUM	12	12	11
CARBON TETRACHLORIDE	(0.41) 0.10	(0.41) 0.10	(100) 17
CHLORDANE	0.29	0.29	0.04

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 9.0			
Table B:	Soil remediation criteria (ug/g)		Nonpotable groundwater criteria (ug/l)
Chemical compound	Residential/ parkland land use	Industrial/ commercial land use	Both land use categories
CHLOROANILINE, p-	1.3	1.3	100
CHLOROBENZENE	(11) 8.0	(11) 8.0	500
CHLOROFORM	(1.7) 0.79	(1.7) 0.79	(2700) 430
CHLOROPHENOL, 2-	10	10	44000
CHROMIUM (TOTAL)	(1000) 750	(1000) 750	2000
CHROMIUM (VI)	(10) 8.0	(10) 8.0	110
CHRYSENE	12	19	3.0
COBALT	(50) 40	(100) 80	100
COPPER	(300) 225	(300) 225	23
CYANIDE (FREE)	100	100	52
DIBENZO(a,h)ANTHRACENE	1.2	1.9	0.25
DIBROMOCHLOROMETHANE	10	18	50000
DICHLOROBENZENE, 1,2- (o-DCB)	30	30	7600
DICHLOROBENZENE, 1,3- (m-DCB)	30	30	7600
DICHLOROBENZENE, 1,4- (p-DCB)	30	30	7600
DICHLOROBENZIDINE, 3,3'-	1.3	1.3	1600
DDD	2.2	3.5	6.0
DDE	1.6	2.4	20
DDT	1.6	2.0	0.05
DICHLOROETHANE, 1,1-	(53) 22	(53) 22	(50000) 9000
DICHLOROETHANE, 1,2-	(0.034) 0.022	(0.034) 0.022	(110) 17
DICHLOROETHYLENE, 1,1-	(0.0085) 0.0024	(0.0085) 0.0024	(4.1) 0.66
DICHLOROETHYLENE, CIS-1,2-	2.3*	2.3*	70*
DICHLOROETHYLENE, TRANS-1,2-	4.1*	4.1*	100*
DICHLOROPHENOL, 2,4-	10	10	3700
DICHLOROPROPANE, 1,2-	(0.035) 0.019	(0.035) 0.019	(58) 9.3
DICHLOROPROPENE, 1,3-	(0.015) 0.0066	(0.015) 0.0066	(24) 3.8
DIELDRIN	0.05	0.05	0.02

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 9.0			
Table B:	Soil remediation criteria (ug/g)		Nonpotable groundwater criteria (ug/l)
Chemical compound	Residential/ parkland land use	Industrial/ commercial land use	Both land use categories
DIETHYL PHTHALATE	0.71	0.71	30
DIMETHYL PHTHALATE	0.7	0.7	30
DIMETHYLPHENOL, 2,4-	140	140	21000
DINITROPHENOL, 2,4-	4.1	4.1	1500
DINITROTOLUENE, 2,4-	1.1	1.8	2300
DIOXIN/FURAN (ng TEQ/g soil)	1.0	1.0	0.000015
ENDOSULFAN	0.29	0.29	0.56
ENDRIN	0.05	0.05	0.05
ETHYLBENZENE	(350) 290	(350) 290	(50000) 28000
ETHYLENE DIBROMIDE	(0.007) 0.0056	(0.007) 0.0056	(21) 3.3
FLUORANTHENE	40	40	130
FLUORENE	350	350	290
HEPTACHLOR	0.084	0.084	0.04
HEPTACHLOR EPOXIDE	0.06	0.09	(37) 6.0
HEXACHLOROBENZENE	0.46	0.76	(3.9) 0.62
HEXACHLOROBUTADIENE	(0.4) 0.38	(0.4) 0.38	(5.4) 0.87
HEXACHLOROCYCLOHEXANE, GAMMA	0.41	0.49	0.8
HEXACHLOROETHANE	(3.9) 3.8	(3.9) 3.8	(78) 12
INDENO(1,2,3-cd)PYRENE	12	19	0.27
LEAD	200	1000	32
MERCURY	10	10	0.12
METHOXYCHLOR	4.0	4.0	0.3
METHYL ETHYL KETONE	38	38	50000
METHYL ISOBUTYL KETONE	(62) 58	(62) 58	50000
METHYL MERCURY	6.8**	10**	0.12
METHYL TERT BUTYL ETHER	100	(150) 120	50000
METHYLENE CHLORIDE	120	(200) 140	50000
METHYLNAPHTHALENE, 2-(*1-)	(290) 280	(290) 280	13000

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 9.0			
Table B:	Soil remediation criteria (ug/g)		Nonpotable groundwater criteria (ug/l)
Chemical compound	Residential/ parkland land use	Industrial/ commercial land use	Both land use categories
MOLYBDENUM	40	40	7300
NAPHTHALENE	40	40	(6200) 5900
NICKEL	(200) 150	(200) 150	1600
PENTACHLOROPHENOL	5.0	5.0	130
PETROLEUM HYDROCARBONS(gas/diesel)	1000	1000	N/V
PETROLEUM HYDROCARBONS(heavy oils)	1000	5000	N/V
PHENANTHRENE	40	40	63
PHENOL	40	40	26000
POLYCHLORINATED BIPHENYLS	5.0	25	0.2
PYRENE	1.3	1.3	0.2
SELENIUM	10	10	50
SILVER	(25) 20	(50) 40	1.2
STYRENE	(2.8) 1.2	(2.8) 1.2	(5900) 940
TETRACHLOROETHANE, 1,1,1,2-	(0.06) 0.019	(0.06) 0.019	(38) 6.0
TETRACHLOROETHANE, 1,1,2,2-	(0.043) 0.037	(0.043) 0.037	(140) 22
TETRACHLOROETHYLENE	0.45*	0.45*	5.0*
THALLIUM	4.1	32	400
TOLUENE	(59) 34	(59) 34	(37000) 5900
TRICHLOROBENZENE, 1,2,4-	30	30	500
TRICHLOROETHANE, 1,1,1-	(34)* 26*	(34)* 26*	200*
TRICHLOROETHANE, 1,1,2-	2.3	3.1	(50000) 16000
TRICHLOROETHYLENE	(2.6)* 1.1*	(2.6)* 1.1*	50*
TRICHLOROPHENOL, 2,4,5-	10	10	630
TRICHLOROPHENOL 2,4,6-	10	10	9700
VANADIUM	(250) 200	(250) 200	200
VINYL CHLORIDE	(0.0048) 0.003	(0.0048) 0.003	(1.3) 0.5
XYLENES	(53) 34	(53) 34	(35000) 5600
ZINC	(800) 600	(800) 600	1100

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 9.0			
Table B:	Soil remediation criteria (ug/g)		Nonpotable groundwater criteria (ug/l)
Chemical compound	Residential/ parkland land use	Industrial/ commercial land use	Both land use categories
ELECTRICAL CONDUCTIVITY (mS/cm)	0.70	1.4	N/A
CHLORIDE	N/V	N/V	N/V
NITRATE	N/V	N/V	N/V
NITRITE	N/V	N/V	2000
SODIUM ADSORPTION RATIO (SAR)	5.0	12	N/A
SODIUM	N/V	N/V	N/V

( ) Criterion value in brackets applies to medium and fine textured soils.

+ Boron soil criterion based on hot water extract.

N/A = Not applicable. N/V = No value.

\* Soil or groundwater criterion adopted from Table A (potable groundwater situation) to account for degradation to vinyl chloride.

++ Analysis for methyl mercury is only required when the total mercury criterion is exceeded.

(\*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.



**Table C**

**Subsurface soil criteria for residential/parkland,  
industrial/commercial land use for a potable groundwater  
condition**

Table C: Subsurface soil remediation criteria for two land uses (residential/parkland and industrial/commercial) in a potable groundwater situation.

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 11.0		
Table C:	Soil remediation criteria (ug/g)	
Chemical compound	Residential/ parkland land use	Industrial/ commercial land use
ACENAPHTHENE	15*	15*
ACENAPHTHYLENE	130	130*
ACETONE	3.5*	3.5*
ALDRIN	0.05*	0.08
ANTHRACENE	28*	28*
ANTIMONY	44	44
ARSENIC	(50) 40	N/V
BARIUM	2500	4100
BENZENE	0.24*	0.24*
BENZO(a)ANTHRACENE	6.6*	6.6*
BENZO(a)PYRENE	1.9	7.2
BENZO(b)FLUORANTHENE	18	18*
BENZO(g,h,i)PERYLENE	53	53
BENZO(k)FLUORANTHENE	18	18*
BERYLLIUM	1.2*	3.1
BIPHENYL, 1,1-	0.89*	0.89*
BIS(2-CHLOROETHYL)ETHER	0.66*	0.66*
BIS(2-CHLOROISOPROPYL)ETHER	0.66*	0.66*
BIS(2-ETHYLHEXYL)PHTHALATE	100*	100*
BORON (AVAILABLE)	2.0*	N/V
BROMODICHLOROMETHANE	0.12*	0.12*
BROMOFORM	0.11*	0.11*
BROMOMETHANE	(12) 4.5	(12) 4.5
CADMIUM	41	41
CARBON TETRACHLORIDE	1.0	1.0
CHLORDANE	0.29*	0.29*
CHLOROANILINE, p-	1.3*	1.3*

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 11.0		
Table C:	Soil remediation criteria (ug/g)	
Chemical compound	Residential/ parkland land use	Industrial/ commercial land use
CHLOROBENZENE	2.4*	2.4*
CHLOROFORM	0.13*	0.13*
CHLOROPHENOL, 2-	0.1*	0.1*
CHROMIUM (TOTAL)	2500	5000
CHROMIUM (VI)	600	1100
CHRYSENE	17	17
COBALT	2500	3400
COPPER	2500	2500
CYANIDE (FREE)	100*	390
DIBENZO(a,h)ANTHRACENE	1.9	7.2
DIBROMOCHLOROMETHANE	0.09*	0.09*
DICHLOROBENZENE, 1,2- (o-DCB)	0.88*	0.88*
DICHLOROBENZENE, 1,3- (m-DCB)	190	190
DICHLOROBENZENE, 1,4- (p-DCB)	0.32*	0.32*
DICHLOROBENZIDINE, 3,3'-	1.3*	2.7
DDD	3.5	13
DDE	2.4	8.9
DDT	2.0	2.0*
DICHLOROETHANE, 1,1-	3.0*	3.0*
DICHLOROETHANE, 1,2-	0.05	0.05
DICHLOROETHYLENE, 1,1-	(0.42) 0.07	(0.42) 0.07
DICHLOROETHYLENE, CIS-1,2-	2.3	2.3
DICHLOROETHYLENE, TRANS-1,2-	4.1	4.1
DICHLOROPHENOL, 2,4-	0.3*	0.3*
DICHLOROPROPANE, 1,2-	0.13	0.13
DICHLOROPROPENE, 1,3-	0.04	0.04
DIELDRIN	0.05*	0.05*
DIETHYL PHTHALATE	0.71*	0.71*
DIMETHYL PHTHALATE	0.7*	0.7*
DIMETHYLPHENOL, 2,4-	0.94*	0.94*

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 11.0		
Table C:	Soil remediation criteria (ug/g)	
Chemical compound	Residential/ parkland land use	Industrial/ commercial land use
DINITROPHENOL, 2,4-	0.2*	0.2*
DINITROTOLUENE, 2,4-	0.66*	0.66*
DIOXIN/FURAN (ng TEQ/g soil)	1.0*	N/V
ENDOSULFAN	0.18*	0.18*
ENDRIN	0.05*	0.05*
ETHYLBENZENE	0.28*	0.28*
ETHYLENE DIBROMIDE	0.012	0.012
FLUORANTHENE	840	840
FLUORENE	340*	340*
HEPTACHLOR	0.15	0.15
HEPTACHLOR EPOXIDE	0.09	0.33
HEXACHLOROBENZENE	0.76	2.8
HEXACHLOROBUTADIENE	2.2	2.2
HEXACHLOROCYCLOHEXANE, GAMMA	0.49	0.49*
HEXACHLOROETHANE	8.5	8.5
INDENO(1,2,3-cd)PYRENE	19	53
LEAD	1000	N/V
MERCURY	57	57
METHOXYCHLOR	4.0*	4.0*
METHYL ETHYL KETONE	0.27*	0.27*
METHYL ISOBUTYL KETONE	0.48*	0.48*
METHYL MERCURY	18**	18**
METHYL TERT BUTYL ETHER	5.7*	5.7*
METHYLENE CHLORIDE	1.1*	1.1*
METHYLNAPHTHALENE, 2-(*1-)	1.2*	1.2*
MOLYBDENUM	550	550
NAPHTHALENE	4.6*	4.6*
NICKEL	710	710
PENTACHLOROPHENOL	12	43
PETROLEUM HYDROCARBONS(gas/diesel)	100*	100*

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 11.0		
Table C:	Soil remediation criteria (ug/g)	
Chemical compound	Residential/ parkland land use	Industrial/ commercial land use
PETROLEUM HYDROCARBONS(heavy oils)	1000*	1000*
PHENANTHRENE	150	150
PHENOL	64	64
POLYCHLORINATED BIPHENYLS	25	N/V
PYRENE	1.3*	1.3*
SELENIUM	2500	2500
SILVER	240	240
STYRENE	1.7**	1.7**
TETRACHLOROETHANE, 1,1,1,2-	0.39	0.39
TETRACHLOROETHANE, 1,1,2,2-	0.01*	0.01*
TETRACHLOROETHYLENE	0.45	0.45
THALLIUM	32	150
TOLUENE	2.1*	2.1*
TRICHLOROBENZENE, 1,2,4-	110	110
TRICHLOROETHANE, 1,1,1-	34	34
TRICHLOROETHANE, 1,1,2-	0.28*	0.28*
TRICHLOROETHYLENE	3.9	3.9
TRICHLOROPHENOL, 2,4,5-	3.2*	3.2*
TRICHLOROPHENOL 2,4,6-	0.66*	0.66*
VANADIUM	910	910
VINYL CHLORIDE	(0.25) 0.094	(0.25) 0.094
XYLENES	25*	25*
ZINC	2500	5000
ELECTRICAL CONDUCTIVITY (mS/cm)	N/A	N/A
CHLORIDE	N/V	N/V
NITRATE	N/V	N/V
NITRITE	N/V	N/V
SODIUM ADSORPTION RATIO (SAR)	N/A	N/A
SODIUM	N/V	N/V

- ( ) Criterion value in brackets applies to medium and fine textured soils.
  - \* Criterion value is the same as the corresponding criterion in Table A.
  - \*\* Criterion value is the same as the corresponding medium/fine textured soil criterion in Table A.
  - + Boron soil criterion based on hot water extract.
  - ++ Analysis for methyl mercury is only required when the total mercury criterion is exceeded.
  - (\*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are present in the soil, the sum of the two concentrations cannot exceed the soil criterion.
- N/A = Not applicable, N/V = No Value.

**Table D**

**Subsurface soil criteria for residential/parkland,  
industrial/commercial land use for a nonpotable groundwater  
condition**

Table D: Subsurface soil remediation criteria for two land uses (residential/parkland and industrial/commercial) in a nonpotable groundwater situation.

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 11.0		
Table D:	Soil remediation criteria (ug/g)	
Chemical compound	Residential/ parkland land use	Industrial/ commercial land use
ACENAPHTHENE	1300	1300*
ACENAPHTHYLENE	840	840*
ACETONE	3.8*	3.8*
ALDRIN	0.05*	0.15
ANTHRACENE	28*	28*
ANTIMONY	44	44**
ARSENIC	(50) 40	N/V
BARIUM	2500	4100
BENZENE	63	(230) 89
BENZO(a)ANTHRACENE	170	170
BENZO(a)PYRENE	1.9	7.2
BENZO(b)FLUORANTHENE	19	72
BENZO(g,h,i)PERYLENE	53	53
BENZO(k)FLUORANTHENE	19	37
BERYLLIUM	1.2*	3.1
BIPHENYL, 1,1-	4.3*	4.3*
BIS(2-CHLOROETHYL)ETHER	0.66*	0.66*
BIS(2-CHLOROISOPROPYL)ETHER	2.6	(9.3) 4.7
BIS(2-ETHYLHEXYL)PHTHALATE	330	500
BORON (AVAILABLE)	2.0*	N/V
BROMODICHLOROMETHANE	25	90
BROMOFORM	(120) 19	(120) 19
BROMOMETHANE	(20) 4.5	(20) 4.5
CADMIUM	41	41
CARBON TETRACHLORIDE	(12) 3.3	(20) 3.3
CHLORDANE	0.29*	0.29*
CHLOROANILINE, p-	1.3*	1.3*
CHLOROBENZENE	40	40



Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 11.0		
Table D:	Soil remediation criteria (ug/g)	
Chemical compound	Residential/ parkland land use	Industrial/ commercial land use
CHLOROFORM	(71) 11	(71) 11
CHLOROPHENOL, 2-	240	800
CHROMIUM (TOTAL))	2500	5000
CHROMIUM (VI)	600	1100
CHRYSENE	19	72
COBALT	2500	3400
COPPER	2500	2500
CYANIDE (FREE)	100*	390
DIBENZO(a,h)ANTHRACENE	1.9	7.2
DIBROMOCHLOROMETHANE	18	67
DICHLOROBENZENE, 1,2- (o-DCB)	500	500
DICHLOROBENZENE, 1,3- (m-DCB)	500	500
DICHLOROBENZENE, 1,4- (p-DCB)	63	230
DICHLOROBENZIDINE, 3,3'-	1.3*	2.7
DDD	3.5	13
DDE	2.4	8.9
DDT	2.0	2.0*
DICHLOROETHANE, 1,1-	(500) 390	(500) 390
DICHLOROETHANE, 1,2-	(1.0) 0.16	(1.0) 0.16
DICHLOROETHYLENE, 1,1-	(0.42) 0.07	(0.42) 0.07
DICHLOROETHYLENE, CIS-1,2-	2.3*	2.3*
DICHLOROETHYLENE, TRANS-1,2-	4.1*	4.1*
DICHLOROPHENOL, 2,4-	94	94
DICHLOROPROPANE, 1,2-	(1.5) 0.23	(1.5) 0.23
DICHLOROPROPENE, 1,3-	(0.62) 0.10	(0.62) 0.10
DIELDRIN	0.05*	0.05*
DIETHYL PHTHALATE	0.71*	0.71*
DIMETHYL PHTHALATE	0.7*	0.7*
DIMETHYLPHENOL, 2,4-	140*	140*
DINITROPHENOL, 2,4-	4.1*	4.1*

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 11.0		
Table D:	Soil remediation criteria (ug/g)	
Chemical compound	Residential/ parkland land use	Industrial/ commercial land use
DINITROTOLUENE, 2,4-	1.8	6.6
DIOXIN/FURAN (ng TEQ/g soil)	1.0*	N/V
ENDOSULFAN	0.29*	0.29*
ENDRIN	0.05*	0.05*
ETHYLBENZENE	1000	2500
ETHYLENE DIBROMIDE	0.02	(0.066) 0.038
FLUORANTHENE	840	840
FLUORENE	350*	350*
HEPTACHLOR	0.15	0.15
HEPTACHLOR EPOXIDE	0.09	0.33
HEXACHLOROBENZENE	0.76	2.8
HEXACHLOROBUTADIENE	(11) 4.3	(27) 4.3
HEXACHLOROCYCLOHEXANE, GAMMA	0.49	0.49*
HEXACHLOROETHANE	13	(47) 42
INDENO(1,2,3-cd)PYRENE	19	70
LEAD	1000	N/V
MERCURY	57	57
METHOXYCHLOR	4.0*	4.0*
METHYL ETHYL KETONE	38*	38*
METHYL ISOBUTYL KETONE	69	69
METHYL MERCURY	18**	18**
METHYL TERT BUTYL ETHER	410	410
METHYLENE CHLORIDE	200	740
METHYLNAPHTHALENE, 2-(*1-)	1600	1600
MOLYBDENUM	550	550
NAPHTHALENE	(1400) 1300	(1400) 1300
NICKEL	710	710
PENTACHLOROPHENOL	12	43
PETROLEUM HYDROCARBONS(gas/diesel)	5000	(10000) 5000
PETROLEUM HYDROCARBONS(heavy oils)	5000	(10000) 5000*

Soil criteria for inorganics in this table apply only where soil pH is 5.0 To 11.0		
Table D:	Soil remediation criteria (ug/g)	
Chemical compound	Residential/ parkland land use	Industrial/ commercial land use
PHENANTHRENE	150	150
PHENOL	390	390
POLYCHLORINATED BIPHENYLS	25	N/V
PYRENE	1.3*	1.3*
SELENIUM	2500	2500
SILVER	240	240
STYRENE	(28) 16	(99) 16
TETRACHLOROETHANE, 1,1,1,2-	(2.9) 0.46	(2.9) 0.46
TETRACHLOROETHANE, 1,1,2,2-	(0.64) 0.22	(1.4) 0.22
TETRACHLOROETHYLENE	0.45*	0.45*
THALLIUM	32	150
TOLUENE	(1000) 510	(2500) 510
TRICHLOROBENZENE, 1,2,4-	770	770
TRICHLOROETHANE, 1,1,1-	34*	34*
TRICHLOROETHANE, 1,1,2-	3.1	12
TRICHLOROETHYLENE	3.9*	3.9*
TRICHLOROPHENOL, 2,4,5-	10*	10*
TRICHLOROPHENOL 2,4,6-	59	220
VANADIUM	910	910
VINYL CHLORIDE	(0.25) 0.094	(0.25) 0.094
XYLENES	(1000) 460	(2500) 460
ZINC	2500	5000
ELECTRICAL CONDUCTIVITY (mS/cm)	N/A	N/A
CHLORIDE	N/V	N/V
NITRATE	N/V	N/V
NITRITE	N/V	N/V
SODIUM ADSORPTION RATIO (SAR)	N/A	N/A
SODIUM	N/V	N/V

( ) Criterion value in brackets applies to medium and fine textured soils.

\* Criterion value is the same as the corresponding criterion in Table B.

- \*\* Criterion value is the same as the corresponding medium/fine textured soil criterion in Table B.
- + Boron soil criterion based on hot water extract.
- a Soil criterion adopted from Table C (potable groundwater situation) to account for degradation to vinyl chloride.
- ++ Analysis for methyl mercury is only required when the total mercury criterion is exceeded.

Footnotes for Table D continued.

(\*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are present in the soil, the sum of the two concentrations cannot exceed the soil criterion.

N/A = Not applicable; N/V = No value.

<p><b>Table E</b></p> <p><b>Sediment quality criteria</b></p>
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Table E: Sediment quality criteria

Table E:	Lowest effect level <sup>a</sup> (ug/g dry wt.)
Chemical compound	All land use categories
ACENAPHTHENE	*
ACENAPHTHYLENE	*
ACETONE	*
ALDRIN	0.002
ANTHRACENE	0.22
ANTIMONY	*
ARSENIC	6.0
BARIUM	*
BENZENE	*
BENZO(a)ANTHRACENE	0.32
BENZO(a)PYRENE	0.37
BENZO(b)FLUORANTHENE	*
BENZO(g,h,i)PERYLENE	0.17
BENZO(k)FLUORANTHENE	0.24
BERYLLIUM	*
BIPHENYL, 1,1-	*
BIS(2-CHLOROETHYL)ETHER	*
BIS(2-CHLOROISOPROPYL)ETHER	*
BIS(2-ETHYLHEXYL)PHTHALATE	*
BORON	*
BROMODICHLOROMETHANE	*
BROMOFORM	*
BROMOMETHANE	*
CADMIUM	0.6
CARBON TETRACHLORIDE	*
CHLORDANE	0.007
CHLOROANILINE, p-	*
CHLOROBENZENE	*
CHLOROFORM	*
CHLOROPHENOL, 2-	*
CHROMIUM (TOTAL)	26

Table E:	Lowest effect level* (ug/g dry wt.)
Chemical compound	All land use categories
CHROMIUM (VI)	*
CHRYSENE	0.34
COBALT	50 <sup>b</sup>
COPPER	16
CYANIDE (FREE)	0.1 <sup>b</sup>
DIBENZO(a,h)ANTHRACENE	0.06
DIBROMOCHLOROMETHANE	*
DICHLOROBENZENE, 1,2- (o-DCB)	*
DICHLOROBENZENE, 1,3- (m-DCB)	*
DICHLOROBENZENE, 1,4- (p-DCB)	*
DICHLOROBENZIDINE, 3,3'-	*
DDD	0.008
DDE	0.005
DDT	0.007
DICHLOROETHANE, 1,1-	*
DICHLOROETHANE, 1,2-	*
DICHLOROETHYLENE, 1,1-	*
DICHLOROETHYLENE, CIS-1,2-	*
DICHLOROETHYLENE, TRANS-1,2-	*
DICHLOROPHENOL, 2,4-	*
DICHLOROPROPANE, 1,2-	*
DICHLOROPROPENE, 1,3-	*
DIELDRIN	0.002
DIETHYL PHTHALATE	*
DIMETHYL PHTHALATE	*
DIMETHYLPHENOL, 2,4-	*
DINITROPHENOL, 2,4-	*
DINITROTOLUENE, 2,4-	*
DIOXIN/FURAN (ng TEQ/g sediment)	*
ENDOSULFAN	*
ENDRIN	0.003
ETHYLBENZENE	*

Table E:	Lowest effect level <sup>a</sup> (ug/g dry wt.)
Chemical compound	All land use categories
ETHYLENE DIBROMIDE	*
FLUORANTHENE	0.75
FLUORENE	0.19
HEPTACHLOR	*
HEPTACHLOR EPOXIDE	0.005 <sup>c</sup>
HEXACHLOROBENZENE	0.02
HEXACHLOROBUTADIENE	*
HEXACHLOROCYCLOHEXANE, GAMMA	*
HEXACHLOROETHANE	*
INDENO(1,2,3-cd)PYRENE	0.2
LEAD	31
MERCURY	0.2
METHOXYCHLOR	*
METHYL ETHYL KETONE	*
METHYL ISOBUTYL KETONE	*
METHYL MERCURY	*
METHYL TERT BUTYL ETHER	*
METHYLENE CHLORIDE	*
METHYLNAPHTHALENE, 2-(1-)	*
MOLYBDENUM	*
NAPHTHALENE	*
NICKEL	16
PENTACHLOROPHENOL	*
PHENANTHRENE	0.56
PHENOL	*
POLYCHLORINATED BIPHENYLS	0.07
PYRENE	0.49
SELENIUM	*
SILVER	0.5 <sup>b</sup>
STYRENE	*
TETRACHLOROETHANE, 1,1,1,2-	*
TETRACHLOROETHANE, 1,1,2,2-	*



Table E:	Lowest effect level <sup>a</sup> (ug/g dry wt.)
Chemical compound	All land use categories
TETRACHLOROETHYLENE	*
THALLIUM	*
TOLUENE	*
TOTAL PETROLEUM HYDROCARBONS (gas/diesel)	*
TOTAL PETROLEUM HYDROCARBONS (heavy oils)	*
TRICHLOROBENZENE, 1,2,4-	*
TRICHLOROETHANE, 1,1,1-	*
TRICHLOROETHANE, 1,1,2-	*
TRICHLOROETHYLENE	*
TRICHLOROPHENOL, 2,4,5-	*
TRICHLOROPHENOL 2,4,6-	*
VANADIUM	*
VINYL CHLORIDE	*
XYLENES	*
ZINC	120
ELECTRICAL CONDUCTIVITY (mS/cm)	N/A
CHLORIDE	*
NITRITE/NITRATE	*
SODIUM ADSORPTION RATIO (SAR)	N/A
SODIUM	*

<sup>a</sup> Lowest effects levels are based on the 5th percentile of the screening level concentration (SLC)

<sup>b</sup> Parameter was carried over from the Open Water Disposal guidelines and is to be treated as a lowest effects level.

<sup>c</sup> - 10% SLC.

\* No value derived.

N/A = Not applicable.

Note:

Criteria for the chemical compounds in the above table were taken from the MOEE Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario (August, 1993). In the event of a discrepancy, sediment quality values found in the most recent version of the MOEE Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario should be deemed correct.

**Table F**

**Ontario Typical Range soil concentrations  
(background)**

TABLE F: Ontario background soil concentrations

Chemical Compound	Soil Background Concentration (ug/g)	
	Agricultural Land Use	All Other Land Uses
ACENAPHTHENE	0.05	0.07
ACENAPHTHYLENE	0.08	0.08
ACETONE	*	*
ALDRIN	0.05	0.05
ANTHRACENE	0.05	0.16
ANTIMONY	1.0	1.0
ARSENIC	14	17
BARIUM	190	210
BENZENE	0.002	0.002
BENZO(a)ANTHRACENE	0.10	0.74
BENZO(a)PYRENE	0.10	0.49
BENZO(b)FLUORANTHENE	0.30	0.47
BENZO(g,h,i)PERYLENE	0.20	0.68
BENZO(k)FLUORANTHENE	0.05	0.48
BERYLLIUM	1.2	1.2
BIPHENYL, 1,1-	*	*
BIS(2-CHLOROETHYL)ETHER	*	*
BIS(2-CHLOROISOPROPYL)ETHER	*	*
BIS(2-ETHYLHEXYL)PHTHALATE	*	*
BROMODICHLOROMETHANE	*	*
BROMOFORM	0.002	0.002
BROMOMETHANE	0.003	0.003
CADMIUM	1.0	1.0
CARBON TETRACHLORIDE	0.002	0.002
CHLORDANE	0.05	0.05
CHLOROANILINE, p-	*	*
CHLOROBENZENE	0.002	0.002
CHLOROFORM	0.006	0.006
CHLOROPHENOL, 2-	0.1	0.1
CHROMIUM (TOTAL)	67	71
CHROMIUM (VI)	2.5	2.5

TABLE F:	Soil Background Concentration (ug/g)	
	Chemical Compound	
	Agricultural Land Use	All Other Land Uses
CHRYSENE	0.18	0.69
COBALT	19	21
COPPER	56	85
CYANIDE (FREE)	0.12	0.12
DIBENZO(a,h)ANTHRACENE	0.15	0.16
DIBROMOCHLOROMETHANE	0.003	0.003
DICHLOROBENZENE, 1,2- (o-DCB)	0.002	0.002
DICHLOROBENZENE, 1,3- (m-DCB)	0.002	0.002
DICHLOROBENZENE, 1,4- (p-DCB)	0.002	0.002
DICHLOROBENZIDINE, 3,3'-	*	*
DDD	*	*
DDE	*	*
DDT	0.12	1.4
DICHLOROETHANE, 1,1-	0.002	0.002
DICHLOROETHANE, 1,2-	0.002	0.002
DICHLOROETHYLENE, 1,1-	0.002	0.002
DICHLOROETHYLENE, CIS-1,2-	*	*
DICHLOROETHYLENE, TRANS-1,2-	0.003	0.003
DICHLOROPHENOL, 2,4-	0.1	0.1
DICHLOROPROPANE, 1,2-	0.002	0.002
DICHLOROPROPENE, 1,3-	0.003	0.003
DIELDRIN	0.05	0.05
DIETHYL PHTHALATE	*	*
DIMETHYL PHTHALATE	*	*
DIMETHYLPHENOL, 2,4-	0.2	0.2
DINITROPHENOL, 2,4-	0.2	0.2
DINITROTOLUENE, 2,4-	*	*
DIOXIN/FURAN (ng TEQ/g soil)	0.007	0.007
ENDOSULFAN	*	*
ENDRIN	0.05	0.05
ETHYLBENZENE	0.002	0.002
ETHYLENE DIBROMIDE	0.004	0.004

TABLE F:	Soil Background Concentration (ug/g)	
	Chemical Compound	
	Agricultural Land Use	All Other Land Uses
FLUORANTHENE	0.24	1.1
FLUORENE	0.05	0.12
HEPTACHLOR	0.05	0.05
HEPTACHLOR EPOXIDE	0.05	0.05
HEXACHLOROBENZENE	*	*
HEXACHLOROBUTADIENE	*	*
HEXACHLOROCYCLOHEXANE, GAMMA	*	*
HEXACHLOROETHANE	*	*
INDENO(1,2,3-cd)PYRENE	0.11	0.38
LEAD	55	120
MERCURY	0.16	0.23
METHOXYCHLOR	0.05	0.05
METHYL ETHYL KETONE	*	*
METHYL ISOBUTYL KETONE	*	*
METHYL MERCURY	*	*
METHYL TERT BUTYL ETHER	*	*
METHYLENE CHLORIDE	0.003	0.003
METHYLNAPHTHALENE, 1-	0.05	0.26
METHYLNAPHTHALENE, 2-	0.05	0.29
MOLYBDENUM	2.5	2.5
NAPHTHALENE	0.05	0.09
NICKEL	43	43
PENTACHLOROPHENOL	0.1	0.1
PETROLEUM HYDROCARBONS(gas/diesel)	*	*
PETROLEUM HYDROCARBONS(heavy oils)	*	*
PHENANTHRENE	0.19	0.69
PHENOL	0.1	0.1
POLYCHLORINATED BIPHENYLS	0.3	0.3
PYRENE	0.19	1.0
SELENIUM	1.4	1.9
SILVER	0.35	0.42
STYRENE	0.002	0.002

TABLE F:	Soil Background Concentration (ug/g)	
	Chemical Compound	Soil Background Concentration (ug/g)
	Agricultural Land Use	All Other Land Uses
TETRACHLOROETHANE, 1,1,1,2-	*	*
TETRACHLOROETHANE, 1,1,2,2-	0.004	0.004
TETRACHLOROETHYLENE	0.002	0.002
THALLIUM	2.5	2.5
TOLUENE	0.002	0.002
TRICHLOROBENZENE, 1,2,4-	*	*
TRICHLOROETHANE, 1,1,1-	0.008	0.009
TRICHLOROETHANE, 1,1,2-	0.002	0.002
TRICHLOROETHYLENE	0.004	0.004
TRICHLOROPHENOL, 2,4,5-	0.1	0.1
TRICHLOROPHENOL 2,4,6-	0.1	0.1
VANADIUM	91	91
VINYL CHLORIDE	0.003	0.003
XYLENES	0.002	0.002
ZINC	150	160
ELECTRICAL CONDUCTIVITY (mS/cm)	0.47	0.57
CHLORIDE	58	330
NITROGEN (TOTAL %)	0.7	0.7
NITRITE/NITRATE	40	61
SODIUM ADSORPTION RATIO (SAR)	1.0	2.4

Note: \* No value derived.

## **APPENDIX 3**

**Draft Section 18 orders  
for  
stratified site condition and  
site specific risk assessment/risk management  
and  
Schedule A:  
Record of Site Condition**

**Environmental Protection Act, sections 18 and 197**

**O R D E R**  
[for stratified site condition]

TO: [Owner of the Property]

**PART 1 LEGAL AUTHORITY AND REASONS**

- 1 Pursuant to subsection 1(1) of the *Environmental Protection Act*, R.S.O. 1990, c.E. 19, as amended (EPA), "contaminant" means any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination of any of them resulting directly or indirectly from human activities that may cause an adverse effect.
- 2 Subsection 18(1) of the EPA provides that the Director may, by order, require a person who owns or owned or who has or had management or control of an undertaking or property to do any one or more of the following:
  1. To have available at all times, or during such periods of time as are specified in the order, the equipment, material and personnel specified in the order at the locations specified in the order.
  2. To obtain, construct and install or modify the devices, equipment and facilities specified in the order at the locations and in the manner specified in the order.
  3. To implement procedures specified in the order.
  4. To take all steps necessary so that procedures specified in the order will be implemented in the event that a contaminant is discharged into the natural environment from the undertaking or property.
  5. To monitor and record the discharge into the natural environment of a contaminant specified in the order and to report thereon to the Director.
  6. To study and to report to the Director upon,
    - i. measures to control the discharge into the natural environment of a contaminant specified in the order,
    - ii. the effects of the discharge into the natural environment of a contaminant specified in the order,



- iii. the natural environment into which a contaminant specified in the order is likely to be discharged.
- 3 Subsection 18(2) of the EPA provides that the Director may make an order under subsection 18(1) where the Director is of the opinion, based on reasonable and probable grounds,
- (a) that the nature of the undertaking or of anything on or in the property is such that if a contaminant is discharged into the natural environment from the undertaking or from or on the property, the contaminant will result or is likely to result in an effect mentioned in the definition of "contaminant" in subsection 1(1); and
  - (b) that the requirements specified in the order are necessary or advisable so as,
    - (i) to prevent or reduce the risk of the discharge of the contaminant into the natural environment from the undertaking or from or on the property, or
    - (ii) to prevent, decrease or eliminate an effect mentioned in the definition of "contaminant" in subsection 1(1) that will result or that is likely to result from the discharge of the contaminant into the natural environment from the undertaking or from or on the property.
- 4 Subsection 197(1) of the EPA provides that a person who has authority under the EPA to make an order or decision affecting real property also has authority to prohibit any person with an interest in the property from dealing with the property in any way without first giving a copy of the order or decision to each person acquiring an interest in the property as a result of the dealing.
- 5 Subsection 197(2) of the EPA provides that a certificate setting out such prohibition may be registered in the proper land registry office on the title of the real property to which the prohibition relates, if the certificate is in the prescribed form, is signed by the Director and is accompanied by a registrable description of the property.
- 6 In this order,
- (a) "Guideline" means the Ministry of Environment and Energy Guideline for Use at Contaminated Sites, May 1996.
  - (b) "Surface soil" means soil or overburden which is 1.5 m or less from the soil surface, excluding the thickness of any non-soil surface treatment such as asphalt, concrete or aggregate.
  - (c) "Sub-surface soil" means soil or overburden which is greater than 1.5 m below the soil surface, excluding the thickness of any non-soil surface treatment such as asphalt, concrete or aggregate.

- (d) "Stratified site condition" means that sub-surface soil at the property contains a contaminant at levels which exceed the soil criteria specified in Tables A or B of the Guideline but which do not exceed the soil criteria specified in Tables C or D of the Guideline, and that the surface soil may contain a contaminant which does not exceed the soil criteria specified in Tables A or B of the Guideline.
- (e) "Record of Site Condition" means the document as contained in the Guideline, which is provided to the Ministry of Environment and Energy (Ministry) by the property owner at the completion of remediation activities undertaken in accordance with the Guideline, and which sets out the restored conditions of the property ("RSC").

7 \_\_\_\_\_ is the registered owner of the following parcel of land.

(Property): [legal description of property]

\_\_\_\_\_

\_\_\_\_\_

- 8 The owner [name] has submitted a RSC to the Ministry attached hereto as Schedule "A".
- 9 The RSC states that there is a stratified site condition at the Property and that sub-surface soil at the Property contains a contaminant including [name of contaminant(s)] at levels which exceed the soil criteria specified in Tables A or B of the Guideline but which does not exceed the soil criteria specified in Tables C or D of the Guideline.
- 10 The Guideline provides that where there is a stratified site condition at a site, the sub-surface soil should always remain at depth and that if at some future date the sub-surface soil is brought to and left within 1.5 meters of the surface, further management of the soil will be required.
- 11 I am of the opinion, based on reasonable and probable grounds, that if the sub-surface soil is brought to and left within 1.5 meters of the surface the contaminant(s) will result in or [is/are] likely to result in an adverse effect including the impairment of the quality of the natural environment for any use that can be made of it.
- 12 I am of the opinion, based on reasonable and probable grounds, that the requirements set out in this Order are necessary or advisable so as to prevent or reduce the risk of the discharge of the contaminant into the natural environment from the undertaking or from or on the property or to prevent, decrease or eliminate an adverse effect that will result or that is likely to result from the discharge of the contaminant into the natural environment from the undertaking or from or on the property.

## **PART 2 WORK ORDERED**

Pursuant to section 18 of the Environmental Protection Act, I hereby order you both jointly & severally, to take all steps necessary to do the following and do the following:

- .1 Where any activity causes sub-surface soil at the Property to be disturbed with the result that sub-surface soil is brought to within 1.5 meters of the surface, [the Owner] shall manage the sub-surface soil which does not meet the criteria in Table A or B of the Guideline, and which has been disturbed, to ensure that none of this soil is left within 1.5 metres of the surface.
- .2 Retain a copy of the Report entitled [name and date of report(s)] and within 5 days of the Director making a request for it, provide a copy of it to the Director.

### **REGISTRATION ON TITLE**

- .3 Pursuant to subsection 197(1) of the EPA, I prohibit any dealing with the Property in any way without first giving a copy of this order to each person acquiring an interest in the Property.
- .4 Within 15 days of the date this order was issued, register the Certificate of Prohibition accompanying this order on title to the Property in the appropriate Land Registry Office.
- .5 Immediately after registration of the Certificate of Prohibition provide a duplicate copy of the certificate with registration particulars to the Director.

## **PART 3 GENERAL**

- 1 The requirements of this order are severable. If any requirement of this order or the application of any requirement to any circumstance or person is held invalid, the application of such requirement to other circumstances or persons and the remainder of the order shall not be affected thereby.
- 2 Any request to change a requirement in this order shall be made in writing to the Director with reasons for the request, at least 14 days prior to any compliance date for that requirement.
- 3 The requirements of this order are minimum requirements only and do not relieve you from:
  - (a) complying with any other applicable order, statute, regulation, municipal, provincial or federal law; and
  - (b) obtaining any approvals or consents not specified in this order.

- 4 Notwithstanding the issuance of this order, further or other orders may be issued in accordance with the legislation as circumstances require.
- 5 Subsection 19(1) of the EPA provides that an order of the Director is binding upon the successor or assignee of the person to whom it is directed.
- 6 Subsection 186(2) of the EPA provides that non-compliance with the requirements of this order constitutes an offence.

#### **PART 4 HEARING BEFORE THE ENVIRONMENTAL APPEAL BOARD**

[this section to be filled out if there is an appeal]

**Environmental Protection Act, sections 18 and 197**

**O R D E R**  
[for Level 2 risk management]

TO: [Owner of the Property]

**PART 1 LEGAL AUTHORITY AND REASONS**

- 1 Pursuant to subsection 1(1) of the *Environmental Protection Act*, R.S.O. 1990, c.E. 19, as amended (EPA), "contaminant" means any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination of any of them resulting directly or indirectly from human activities that may cause an adverse effect.
- 2 Subsection 18(1) of the EPA provides that the Director may, by order, require a person who owns or owned or who has or had management or control of an undertaking or property to do any one or more of the following:
  1. To have available at all times, or during such periods of time as are specified in the order, the equipment, material and personnel specified in the order at the locations specified in the order.
  2. To obtain, construct and install or modify the devices, equipment and facilities specified in the order at the locations and in the manner specified in the order.
  3. To implement procedures specified in the order.
  4. To take all steps necessary so that procedures specified in the order will be implemented in the event that a contaminant is discharged into the natural environment from the undertaking or property.
  5. To monitor and record the discharge into the natural environment of a contaminant specified in the order and to report thereon to the Director.
  6. To study and to report to the Director upon,
    - i. measures to control the discharge into the natural environment of a contaminant specified in the order,
    - ii. the effects of the discharge into the natural environment of a contaminant specified in the order,

- iii. the natural environment into which a contaminant specified in the order is likely to be discharged.
- 3 Subsection 18(2) of the EPA provides that the Director may make an order under subsection 18(1) where the Director is of the opinion, based on reasonable and probable grounds,
- (a) that the nature of the undertaking or of anything on or in the property is such that if a contaminant is discharged into the natural environment from the undertaking or from or on the property, the contaminant will result or is likely to result in an effect mentioned in the definition of "contaminant" in subsection 1(1); and
  - (b) that the requirements specified in the order are necessary or advisable so as,
    - (i) to prevent or reduce the risk of the discharge of the contaminant into the natural environment from the undertaking or from or on the property, or
    - (ii) to prevent, decrease or eliminate an effect mentioned in the definition of "contaminant" in subsection 1(1) that will result or that is likely to result from the discharge of the contaminant into the natural environment from the undertaking or from or on the property.
- 4 Subsection 197(1) of the EPA provides that a person who has authority under the EPA to make an order or decision affecting real property also has authority to prohibit any person with an interest in the property from dealing with the property in any way without first giving a copy of the order or decision to each person acquiring an interest in the property as a result of the dealing.
- 5 Subsection 197(2) of the EPA provides that a certificate setting out such prohibition may be registered in the proper land registry office on the title of the real property to which the prohibition relates, if the certificate is in the prescribed form, is signed by the Director and is accompanied by a registrable description of the property.
- 6 In this order,
- (a) "Guideline" means the Ministry of Environment and Energy Guideline for Use at Contaminated Sites, May 1996.
  - (b) "Site specific risk assessment" means a technical, scientific assessment of the nature and magnitude of the human health or environmental risk as outlined in the Guideline, associated with the presence of the contaminant(s) (SSRA).
  - (c) "risk management measures" means physical site controls or mitigative measures which are designed and implemented to prevent an adverse effect or the likelihood of an adverse effect by limiting or eliminating the presence of, or exposure to, the contaminant(s) found at the site, and to eliminate the discharge of the

contaminant(s) into the natural environment.

- (d) "receptor characteristics" are the identified human and/or ecological components which may experience adverse effects including the routes of exposure to the contaminant(s) of interest.
- (e) "Record of Site Condition" means the document as contained in the Guideline, which is provided to the Ministry of Environment and Energy (Ministry) by the property owner at the completion of remediation activities undertaken in accordance with the Guideline, and which sets out the restored conditions of the property ("RSC").

7 \_\_\_\_\_ is the registered owner of the following parcel of land.

(Property): [legal description of property]

\_\_\_\_\_

8 The owner [name] has submitted a RSC to the Ministry attached hereto as Schedule "A".

9 The RSC states that [the owner] has undertaken a SSRA in accordance with the Guideline and that the soil and/or ground water at the Property contains a contaminant including [name of contaminant(s)].

10 The SSRA is described in the report entitled [insert title and date of report(s)] ("Report"), incorporates site specific data including physical site conditions and receptor characteristics and identifies risk management measures which must be maintained to prevent, decrease or eliminate the adverse effect that will result or is likely to result from the discharge of the contaminant into the natural environment.

11 I am of the opinion, based on reasonable and probable grounds, that the failure to maintain the risk management measures and receptor characteristics described in the Report [and/or] the failure to maintain and operate appropriate risk management measures may result in the discharge of a contaminant including [name of contaminant(s)] which would or [is/are] likely to result in an adverse effect.

12 I am of the opinion, based on reasonable and probable grounds, that the requirements set out in this Order are necessary or advisable so as to prevent or reduce the risk of the discharge of the contaminant into the natural environment from the undertaking or from or on the property or to prevent, decrease or eliminate an adverse effect that will result or that is likely to result from the discharge of the contaminant into the natural environment from the undertaking or from or on the property.

## **PART 2. WORK ORDERED**

Pursuant to section 18 of the Environmental Protection Act, I hereby order you both jointly & severally, to take all steps necessary to do the following and do the following:

- 1 Implement, maintain and operate any risk management measures set out in the Report as are necessary to prevent an adverse effect, or the likelihood of an adverse effect.
- 2 In the event of a change in the physical site conditions or receptor characteristics at the site, implement, maintain and operate any risk management measures as are necessary to prevent, decrease or eliminate the adverse effect that will result or is likely to result from the discharge of the contaminant into the natural environment.

### **REGISTRATION ON TITLE**

- 3 Pursuant to subsection 197(1) of the EPA, I prohibit any dealing with the Property in any way without first giving a copy of this order to each person acquiring an interest in the Property.
- 4 Within 15 days of the date this order was issued, register the Certificate of Prohibition accompanying this order on title to the Property in the appropriate Land Registry Office.
- 5 Immediately after registration of the Certificate of Prohibition provide a duplicate copy of the certificate with registration particulars to the Director.

## **PART 3 GENERAL**

- 1 The requirements of this order are severable. If any requirement of this order or the application of any requirement to any circumstance or person is held invalid, the application of such requirement to other circumstances or persons and the remainder of the order shall not be affected thereby.
- 2 Any request to change a requirement in this order shall be made in writing to the Director with reasons for the request, at least 14 days prior to any compliance date for that requirement.
- 3 The requirements of this order are minimum requirements only and do not relieve you from:
  - (a) complying with any other applicable order, statute, regulation, municipal, provincial or federal law; and
  - (b) obtaining any approvals or consents not specified in this order.



- 4 Notwithstanding the issuance of this order, further or other orders may be issued in accordance with the legislation as circumstances require.
- 5 Subsection 19(1) of the EPA provides that an order of the Director is binding upon the successor or assignee of the person to whom it is directed.
- 6 Subsection 186(2) of the EPA provides that non-compliance with the requirements of this order constitutes an offence.

#### **PART 4 HEARING BEFORE THE ENVIRONMENTAL APPEAL BOARD**

[this section to be filled out if there is an appeal]

## Schedule A

### Record of Site Condition

Part 1	.....	Property ownership
Part 2	.....	List of reports
Part 3	.....	Summary of site conditions
Part 4	.....	Summary of risk management measures
Part 5	.....	Final site profile
Part 6	.....	Affidavit of consultant
Part 7	.....	Statement of property owner
Part 8	.....	MOEE acknowledgement of receipt

**Schedule A – Record of Site Condition**  
for the "Guideline for Use at Contaminated Sites", May 1996 (Guideline)

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**Part 1: Property ownership**

Section 167 of the Environmental Protection Act (R.S.O. 1990) states: "No person shall hinder or obstruct a provincial officer in the lawful performance of his or her duties or furnish a provincial officer with false information or refuse to furnish the provincial officer with information required for the purposes of this Act and the regulations."

To:

insert name of Provincial Officer

insert name of District Office

insert address of local MOEE office

From:

Name of property owner <sup>1</sup>

Insert municipal address

Legal description of property

including plot plan number

assessment roll number, etc.

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<sup>1</sup> A Certificate of Status and a certified copy of the most recent deed/transfer for the property must accompany this Record of Site Condition

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**Part 2: List of reports**

This is to certify that information pertaining to the noted property, as outlined in the following reports, has been prepared and/or reviewed by a consultant retained by the owner.

REPORT TITLE	REPORT AUTHOR(S)	COMPANY	DATE

Is there an additional list of consultant reports attached to this Record of Site Condition?  
(Do not include reports)

☐ Yes

☐ No

**Schedule A – Record of Site Condition**  
for the "Guideline for Use at Contaminated Sites", May 1996 (Guideline)

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**Part 3: Summary of site conditions**

Is this a potentially sensitive site? ☐ Yes ☐ No  
Has there been any restoration of the site? ☐ Yes ☐ No

Approach used:

☐ Background ☐ Full depth ☐ Site specific risk assessment ☐ Level 1  
☐ Stratified ☐ (complete Part 4) ☐ Level 2

The site consists of material which is: ☐ coarse textured ☐ fine textured

The site is suitable for the following use(s) as outlined in this guideline:

Land: ☐ Agricultural ☐ Groundwater: ☐ Potable  
☐ Residential/Parkland ☐ Nonpotable  
☐ Industrial/Commercial  
☐ Sensitive use Was the municipality notified? ☐ Yes ☐ No

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**Part 4: Summary of risk management measures**

Provide a summary of any risk management measures and/or engineered controls which have been designed and implemented to allow reuse of the site.

Was public consultation undertaken as part of the risk assessment/risk management process?  
☐ Yes ☐ No

Is an agreement outlining respective responsibilities of the proponent and municipality required?  
☐ Yes ☐ No

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Is there additional information on the risk management measures used attached to this Record of Site Condition?  
(Do not include reorts)

☐ Yes ☐ No

**Schedule A – Record of Site Condition**  
for the "Guideline for Use at Contaminated Sites", May 1996 (Guideline)

**Part 5: Final site profile <sup>1</sup>**

Chemical name	Maximum concentration found on site <sup>2</sup>	Guideline limit or upper concentration limit <sup>2,3</sup>	Sample location with bore hole number; sample depth
<b>Surface soil</b>			
<b>Subsurface soil</b>			
<b>Groundwater (indicate screened interval)</b>			

<sup>1</sup> attach plan view of the site showing locations of bore holes, sample sites and risk management measures.

- <sup>2</sup> soil concentrations should be reported in  $\mu\text{g/g}$  and groundwater concentrations should be reported in  $\mu\text{g/L}$ .  
<sup>3</sup> upper concentration limit to be listed if the site specific risk assessment approach was used, otherwise the guideline limit should be listed for the applicable chemicals.

Are additional pages of the final site profile attached to this Record of Site Condition?  
(Do not include reports)

☐ Yes      ☐ No

## Schedule A – Record of Site Condition

for the "Guideline for Use at Contaminated Sites", May 1996 (Guideline)

### Part 6: Affidavit of consultant

I [Name of consultant] \_\_\_\_\_ Of the Municipality of \_\_\_\_\_  
in the \_\_\_\_\_, MAKE OATH AND SAY AS FOLLOWS:

1. I am the (position/title) \_\_\_\_\_ of (firm/company) \_\_\_\_\_  
\_\_\_\_\_ and have personal knowledge of the matters set out below.
2. I (or name of firm/company) \_\_\_\_\_ was retained or employed as  
the principal consultant to undertake or supervise the assessment and, if necessary, the restoration of  
[property address] \_\_\_\_\_ ("property").
3. I am/am not (delete that which does not apply) employed or retained by the owner of the property or  
company operating on the property in any other capacity.
4. I had the expertise required to perform these services. The details of my expertise and the expertise of  
those subcontractors who performed services at the property are set out in the report(s) noted in Part 2 of  
the Record of Site Condition.
5. All subcontractors employed in the assessment and restoration of the property (strike out and initial if no  
restoration was undertaken at the property) warranted to me that they possessed the expertise required to  
perform the services for which they were employed and carried out.
6. The assessment activities and restoration activities (strike out and initial if no restoration was undertaken at  
the property) at the property requiring the application of scientific principles have been undertaken or  
supervised by a natural scientist qualified to perform such services.
7. The assessment activities and restoration activities (strike out and initial if no restoration was undertaken at  
the property) at the property requiring the application of engineering principles have been undertaken or  
supervised by an engineer qualified to perform such services.
8. The assessment activities and restoration activities (strike out and initial if no restoration was undertaken at  
the property) at the property has been completed in accordance with the MOEE "Guideline for Use at  
Contaminated Sites", May 1996, for the uses set out in Part 3 of the Record of Site Condition and the  
Property meets the criteria set out in the Guideline for that use.
9. I have prepared and/or reviewed the report(s) identified in Part 2 of the Record of Site Condition and am  
not aware of any soil, ground water or sediment contamination on or within the property which would  
interfere with its safe use for the categories set out in Part 3 in the Record of Site Condition.
10. The site specific risk assessment (SSRA) was reviewed by an independent consultant who warranted to me  
that they possessed the expertise required to perform such review. (strike out and initial if no SSRA was  
undertaken at the property)
11. I acknowledge that public authorities and future owners, occupants and others may rely on this statement.

SWORN BEFORE ME at the \_\_\_\_\_ of \_\_\_\_\_  
in the \_\_\_\_\_, this \_\_\_\_ day of \_\_\_\_\_

A Commissioner, etc.

**Schedule A – Record of Site Condition**  
for the "Guideline for Use at Contaminated Sites", May 1996 (Guideline)

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**Part 7: Statement of property owner**

This is to certify that as the owner of the Property (and on behalf of the owner if different), (I have)/(or the owner has) hired \_\_\_\_\_

as the principal consultant ("principal consultant") to undertake or supervise the assessment and if necessary the restoration of the property to make it suitable for the use(s) set out in Part 3 in accordance with the guideline. This is to confirm that the consultant retained by the owner has certified that the assessment and/or restoration activities has been completed in accordance with the guideline. I (*or the owner*) agree to disclose this information and any reports prepared by or for the Principal Consultant and its subcontractors to all parties acquiring or intending to acquire an interest in this property. I am not aware of any environmental conditions affecting the property which would interfere with its safe use for the categories set out in Part 3. I acknowledge that public authorities and future owners, occupants, and others may rely on this Record of Site Condition.

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Name (please print)

Signature

Date

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**Part 8: MOEE acknowledgement of receipt**

The MOEE acknowledges receipt of this Record of Site Condition. The MOEE has not reviewed, considered or commented on the content of the report(s) cited in Part 2 of this Record of Site Condition except where a site specific risk assessment has been submitted for review. The MOEE has not supervised the assessment and/or restoration work undertaken at the property and does not assume any responsibility or liability for the assessment, restoration or environmental conditions of the property, or for notifying future owners or present or future occupants of the property of the assessment, restoration or environmental condition of the property.

Proof of the quality of the property and of the effectiveness of the assessment or restoration undertaken at the property are the responsibility of the owner of the property and subsequent owners. Any persons intending to purchase or occupy the property must assess for themselves the environmental condition of the property, and the extent of responsibility and liability that may arise from taking ownership or from occupying the property.

Where the guideline provides that a Certificate of Prohibition must be registered on title pursuant to a director's order, acknowledgement of receipt of this Record of Site Condition will not be issued until such time as the director is provided with a duplicate copy of the Certificate of Prohibition and evidence that the Certificate of Prohibition has been registered on title.

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Acknowledgement of Receipt  
(signature of Provincial Officer)

Date



## APPENDIX 4

Map of ministry district and regional offices  
and  
listing of addresses and phone numbers

# Ontario Ministry of the Environment and Energy

Region	Regional offices	District offices			
South-Western	<u>LONDON</u> 985 Adelaide St. S. London, Ontario N6E 1V3  (519) 661-2200 - phone (519) 661-1742 - fax	<u>LONDON</u> 985 Adelaide St. S. London, Ontario N6E 1V3  (519) 661-2200 (519) 661-1742	<u>WINDSOR</u> 250 Windsor Ave. 6th Fl. Windsor, Ontario N9A 6V9  (519) 254-2546 (519) 254-5894	<u>SARNIA</u> 265 Front St. N. Suite 109 Sarnia, Ontario N7T 7X1  (519) 336-4030 (519) 336-4280	<u>OWEN SOUND</u> 1180-20th St. Owen Sound, Ontario N4K 6H6  (519) 371-2901 (519) 371-9205
	<u>HAMILTON</u> 119 King St. W. 12th Fl. P.O. Box 2112 Hamilton, Ontario L8N 3Z9  (905) 521-7640 - phone (905) 521-7820 - fax	<u>HAMILTON</u> 119 King St. W. 9th Fl. P.O. Box 2112 Hamilton, Ontario L8N 3Z9  (905) 521-7650 (905) 521-7806	<u>CAMBRIDGE</u> 320 Pinebush Rd. P.O. Box 219 Cambridge, Ontario N1R 5T8  (519) 622-8121 (519) 740-5978	<u>WELLAND</u> 637-641 Niagara St. N. Welland, Ontario L3C 1L9  (905) 732-0816 (905) 685-2658	
Central	<u>TORONTO</u> 5775 Yonge St. 8th Fl. Toronto, Ontario M2M 4J1  (416) 326-6700 - phone (416) 325-6345 - fax	<u>TORONTO</u> 5775 Yonge St. 8th Fl. Toronto, Ontario M2M 4J1  (416) 326-6700 (416) 325-6346	<u>HALTON-PEEL</u> 1235 Trafalgar Rd. Suite 401 Oakville, Ontario L6H 3P1  (905) 815-9520 (905) 815-9501	<u>YORK DURHAM</u> 230 Westney Rd. S. Ajax, Ontario  (905) 427-5600 (905) 427-5602	
	<u>KINGSTON</u> 133 Dalton St. Kingston, Ontario K7L 4X6  (613) 549-4000 - phone (613) 548-6908 - fax	<u>KINGSTON</u> 133 Dalton St. Kingston, Ontario K7L 4X6  (613) 549-4000 (613) 548-6920	<u>OTTAWA</u> 2435 Holly Lane Ottawa, Ontario K1V 7P2  (613) 521-3450 (613) 521-5437	<u>CORNWALL</u> 205 Amelia St. Cornwall, Ontario K6H 3P3  (613) 933-7402 (613) 933-6402	<u>PETERBOROUGH</u> 139 George St. N. Peterborough, Ontario K9J 3G6  (705) 743-2972 (705) 748-4192
Mid-Ontario	<u>SUDBURY</u> 199 Larch St. 11th Fl. Sudbury, Ontario P3E 5P9  (705) 675-4501 - phone (705) 675-4180 - fax	<u>SUDBURY</u> 199 Larch St. 11th Fl. Sudbury, Ontario P3E 5P9  (705) 675-4501 (705) 675-4180	<u>NORTH BAY</u> Northgate Plaza 1500 Fisher St. North Bay, Ontario P1B 2H3  (705) 476-1001 (705) 476-0207	<u>BARRIE</u> 54 Cedar Pointe Dr. Unit 1203 Barrie, Ontario L4N 5R7  (705) 726-1730 (705) 726-5100	<u>MUSKOKA-HALIBURTON</u> 483 Bethune Dr. Gravenhurst, Ontario P0C 1G0  (705) 687-6647 (705) 687-3715
	<u>THUNDER BAY</u> 435 James St. S. 3rd Fl. P.O. Box 5000 Thunder Bay, Ontario P7C 5G6  (807) 475-1205 - phone (807) 475-1754 - fax	<u>THUNDER BAY</u> 435 James St. S. 3rd Fl., P.O. Box 5000 Thunder Bay, Ontario P7C 5G6  (807) 475-1315 (807) 473-3160	<u>KENORA</u> 808 Robertson St. P.O. Box 5150 Kenora, Ontario P9N 1X9  (807) 468-2718 (807) 468-2735	<u>TIMMINS</u> 83 Algonquin Blvd. W. Timmins, Ontario P4N 2R4  (705) 268-3222 (705) 264-7336	<u>SAULT STE. MARIE</u> 445 Albert St. E. Sault Ste. Marie, Ontario P6A 2J9  (705) 949-4640 (705) 945-6868

